

OPERATION MANUAL



MODELS **MLT20DCA** **MLT20DCA6** **DEDICATED LIGHT TOWER**



Revision #0 (01/18/13)

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publication, visit our website at:
www.multiquip.com



THIS MANUAL MUST ACCOMPANY THE EQUIPMENT AT ALL TIMES.

PN 49838

 WARNING 
CALIFORNIA — Proposition 65 Warning
Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects and other reproductive harm.

REPORTING SAFETY DEFECTS

If you believe that your vehicle has a defect that could cause a crash or could cause injury or death, you should immediately inform the National Highway Traffic Safety Administration (NHTSA) in addition to notifying Multiquip at 1-800-421-1244.

If NHTSA receives similar complaints, it may open an investigation, and if it finds that a safety defect exists in a group of vehicles, it may order a recall and remedy campaign. However, NHTSA cannot become involved in individual problems between you, your dealer, or Multiquip.

To contact NHTSA, you may either call the Vehicle Safety Hotline toll-free at 1-888-327-4236 (TTY: 1-800-424-9153), go to <http://www.nhtsa.dot.gov>; or write to:

Administrator
NHTSA
1200 New Jersey Avenue S.E.
Washington, DC 20590

You can also obtain information about motor vehicle safety from <http://www.safercar.gov>.

MLT20 Series Light Tower

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NOTICE

Specifications are subject to change without notice.


SAFETY INFORMATION


Do not operate or service the equipment before reading the entire manual. Safety precautions should be followed at all times when operating this equipment. Failure to read and understand the safety messages and operating instructions could result in injury to yourself and others.


SAFETY MESSAGES

The four safety messages shown below will inform you about potential hazards that could injure you or others. The safety messages specifically address the level of exposure to the operator and are preceded by one of four words: **DANGER**, **WARNING**, **CAUTION** or **NOTICE**.

SAFETY SYMBOLS

 DANGER
Indicates a hazardous situation which, if not avoided, WILL result in DEATH or SERIOUS INJURY .




 WARNING
Indicates a hazardous situation which, if not avoided, COULD result in DEATH or SERIOUS INJURY .

 CAUTION
Indicates a hazardous situation which, if not avoided, COULD result in MINOR or MODERATE INJURY .

NOTICE
Addresses practices not related to personal injury.

SAFETY SYMBOLS

Potential hazards associated with the operation of this equipment will be referenced with hazard symbols which may appear throughout this manual in conjunction with safety messages.

Symbol	Safety Hazard
	Burn hazards
	Explosive fuel hazards
	Electric shock hazards

SAFETY INFORMATION

GENERAL SAFETY

CAUTION

- **NEVER** operate this equipment without proper protective clothing, shatterproof glasses, respiratory protection, hearing protection, steel-toed boots and other protective devices required by the job or city and state regulations.



- **NEVER** operate this equipment when not feeling well due to fatigue, illness or when under medication.
- **NEVER** operate this equipment under the influence of drugs or alcohol.

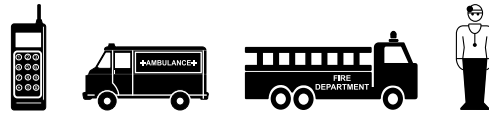


- **ALWAYS** check the equipment for loosened threads or bolts before starting.
- **DO NOT** use the equipment for any purpose other than its intended purposes or applications.

NOTICE

- This equipment should only be operated by trained and qualified personnel 18 years of age and older.
- Whenever necessary, replace nameplate, operation and safety decals when they become difficult read.
- Manufacturer does not assume responsibility for any accident due to equipment modifications. Unauthorized equipment modification will void all warranties.
- **NEVER** use accessories or attachments that are not recommended by Multiquip for this equipment. Damage to the equipment and/or injury to user may result.

- **ALWAYS** know the location of the nearest fire extinguisher.
- **ALWAYS** know the location of the nearest first aid kit.



- **ALWAYS** know the location of the nearest phone or keep a phone on the job site. Also, know the phone numbers of the nearest ambulance, doctor and fire department. This information will be invaluable in the case of an emergency.

SAFETY INFORMATION

LIGHT TOWER SAFETY

DANGER

- **NEVER** operate the equipment in an explosive atmosphere or near combustible materials. An explosion or fire could result causing severe **bodily harm or even death.**



WARNING

- **NEVER** disconnect any **emergency or safety devices.** These devices are intended for operator safety. Disconnection of these devices can cause severe injury, bodily harm or even death. Disconnection of any of these devices will void all warranties.

CAUTION

- **NEVER** lubricate components or attempt service on a running machine.
- **ALWAYS** ensure light tower is on level ground before use so that it cannot slide or shift around, endangering workers. Always keep immediate area free of bystanders.
- **ALWAYS** make sure trailer is leveled with all outriggers extended before raising tower. Outriggers must remain extended while tower is up.
- **ALWAYS** keep area behind trailer clear of people while raising and lowering mast.
- **NEVER** remove safety pin or pull mast locking pin while tower is in a raised position!
- **CHECK** the mast and winch cables for wear. If any problem occurs when lowering or raising the tower, **STOP** immediately! Contact a trained technician for assistance.
- **NEVER** pivot or retract mast while unit is operating.
- **NEVER** use the light tower mast as a crane. **DO NOT** lift anything with the mast.
- **NEVER** attach anything to the light tower mast unless it is an authorized Multiquip component.
- **ALWAYS** lower the light tower when not in use, or if high winds or electrical storms are expected.

NOTICE

- **ALWAYS** keep the immediate area surrounding the light tower clean, neat, and free of debris.
- **ALWAYS** keep the machine in proper running condition.
- Fix damage to machine and replace any broken parts immediately.
- **ALWAYS** store equipment properly when it is not being used. Equipment should be stored in a clean, dry location out of the reach of children and unauthorized personnel.
- To prevent the light tower from overturning, **NEVER** use in winds that exceed 65 mph (105 kph).

LAMP SAFETY

WARNING

- **NEVER** attempt to replace lamp with the power on. Always shut down the engine and turn off circuit breakers when changing the lamp.
- **ALWAYS** allow a sufficient amount of time for the lamp to **cool** before touching or changing. The possibility exists of severe burns.

CAUTION

- **NEVER** use force when installing the lamp. Excessive force could cause the lamp to break, causing bodily harm.

NOTICE

- **NEVER** leave any grease or oil residue on lamp surface when replacing or removing lamp. This can create hot spots, reducing the service life of the lamp.
- **ALWAYS** make sure lamp surface is clean and dry.
- **ALWAYS** replace with MQ recommended type lamp.
- **ALWAYS** have a **trained technician** install and remove a floodlight, or replace any damaged fixture wiring.

SAFETY INFORMATION

TOWING SAFETY

CAUTION

- Check with your local county or state safety towing regulations, in addition to meeting **Department of Transportation (DOT) Safety Towing Regulations**, before towing your light tower.
- In order to reduce the possibility of an accident while transporting the light tower on public roads, **ALWAYS** make sure the trailer that supports the light tower and the towing vehicle are mechanically sound and in good operating condition.
- **ALWAYS** shutdown engine before transporting.
- Make sure the hitch and coupling of the towing vehicle are rated equal to, or greater than the trailer “gross vehicle weight rating.”
- **ALWAYS** inspect the hitch and coupling for wear. **NEVER** tow a trailer with defective hitches, couplings, chains, etc.
- Check the tire air pressure on both towing vehicle and trailer. **Trailer tires should be inflated to 50 psi cold.** Also check the tire tread wear on both vehicles.
- **ALWAYS** make sure the trailer is equipped with a **safety chain**.
- **ALWAYS** properly attach trailer’s safety chains to towing vehicle.
- **ALWAYS** make sure the vehicle and trailer directional, backup, brake and trailer lights are connected and working properly.
- DOT Requirements include the following:
 - Connect and test electric brake operation.
 - Secure portable power cables in cable tray with tie wraps.
- The maximum speed for highway towing is **55 MPH** unless posted otherwise. Recommended off-road towing is not to exceed **15 MPH** or less depending on type of terrain.



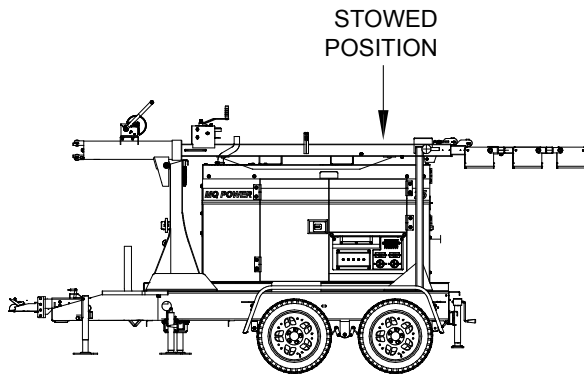
- Avoid sudden stops and starts. This can cause skidding, or jack-knifing. Smooth, gradual starts and stops will improve towing.
- Avoid sharp turns to prevent rolling.
- Trailer should be adjusted to a level position at all times when towing.
- Raise and lock trailer wheel stand in up position when towing.
- Place **chock blocks** underneath wheel to prevent **rolling** while parked.
- Place **support blocks** underneath the trailer’s bumper to prevent **tipping** while parked.
- Use the trailer’s swivel jack to adjust the trailer height to a level position while parked.

SAFETY INFORMATION

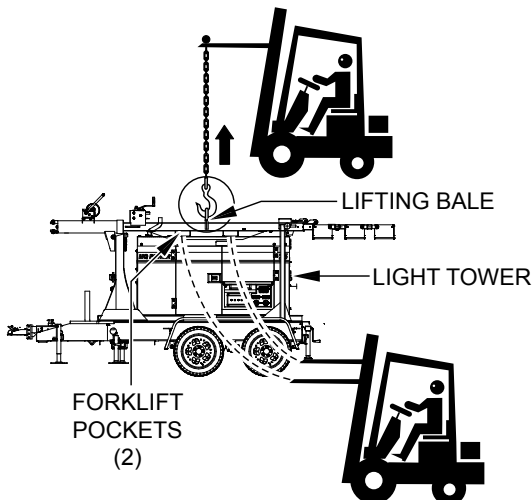
TRANSPORTING SAFETY

⚠ CAUTION

- Before lifting, make sure that light tower parts are not damaged and screws are not loosened or lost.
- **ALWAYS** make sure crane or lifting device has been properly secured to lifting hook of the equipment.
- **NEVER** lift the equipment while engine is running.
- Make sure the tower is in the stowed position before lifting.



- **ALWAYS** Make sure rear mast lock is secure before lifting.
- Use adequate lifting cable (wire or rope) of sufficient strength.
- Use one point suspension hook and lift straight upwards.

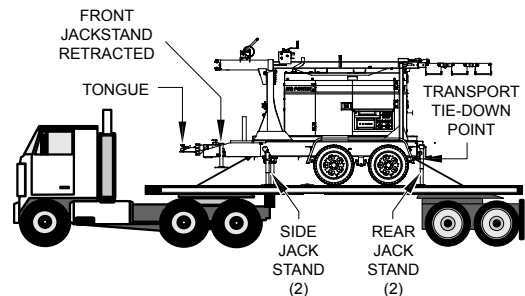


- If lifting through pockets, make sure forks of forklift are inserted in pockets as far as possible before lifting.
- Never allow any person or animal to stand underneath the equipment while lifting.
- **DO NOT** lift equipment to unnecessary heights.

Loading and Tie-Down on Flatbed Truck

NOTICE

- When loading onto flatbed truck, make sure that front jackstand of light tower is retracted and in the horizontal position so that the foot does not make contact with the deck floor.

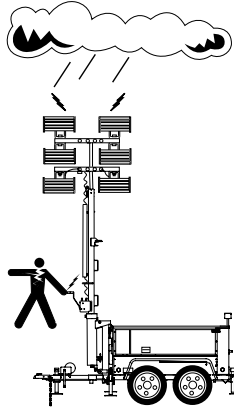


- Make sure that the two side (left and right) and two rear jackstands are in the vertical position, slightly extended, so that each foot makes contact with the deck floor.
- Straps and chains should be routed through the transport tie-down points located beneath each corner of the cabinet to allow even application of force to the front and rear of the machine.
- **DO NOT** secure the unit by running a strap or chain over the tongue of the light tower. This may cause severe damage to the unit.

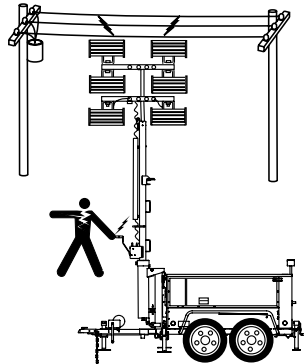
ELECTRICAL SAFETY

DANGER

■ **NEVER** operate light tower or handle any electrical equipment while standing in water, while barefoot, while hands are wet or in the rain. A dangerous **electrical shock** could occur, causing **severe bodily harm or even death**.



■ **ALWAYS** make sure the area above the light tower is open and clear of overhead power lines and other obstructions. The tower extends in excess of 30 feet (9 meters). Contact with overhead power lines or other obstructions could result in equipment damage, **electrical shock, electrocution and even death**.



■ Similar to boom equipment, light tower may become energized with high voltage. **DO NOT** operate the light tower within a radial distance of 17 feet from high voltage power lines. If light tower becomes energized with high voltage, contact with the equipment could result in electrocution.

SPECIFICATIONS

Table 1. MLT20 Series Specifications

Light Tower Specifications		
Weight (with genset/trailer)	With Fuel - 4,450 lb. (2,018 kg.) Without Fuel - 3,740 lb. (1,696 kg.)	
Lamps	MLT20DCA	Four 1,000-Watt Metal Halide
	MLT20DCA6	Six 1,000-Watt Metal Halide
Lumens	660,000	
Light Color	Bright White	
Trailer Specifications		
Trailer Model	TRLR75XF	
Gross Vehicle Weight Rating (GVWR)	7,000 lb (3,175 kg.)	
Gross Axle Weight Rating (GAWR) (ea.)	3,500 lb (1,587 kg)	
Tire Size	ST205/75D15 LR-C	
Tire Load Rating (ea.)	1,820 lb (825 kg)	
Wheel Bolt Pattern	5-Lug on 4.5 in	
Fuel Tank Capacity	100 gal (378 L)	
Generator/Engine Specifications	Refer to Accompanying DCA20SPXU2 Operation and Parts Manual (Part No. 49840) for generator/engine specifications.	

DIMENSIONS

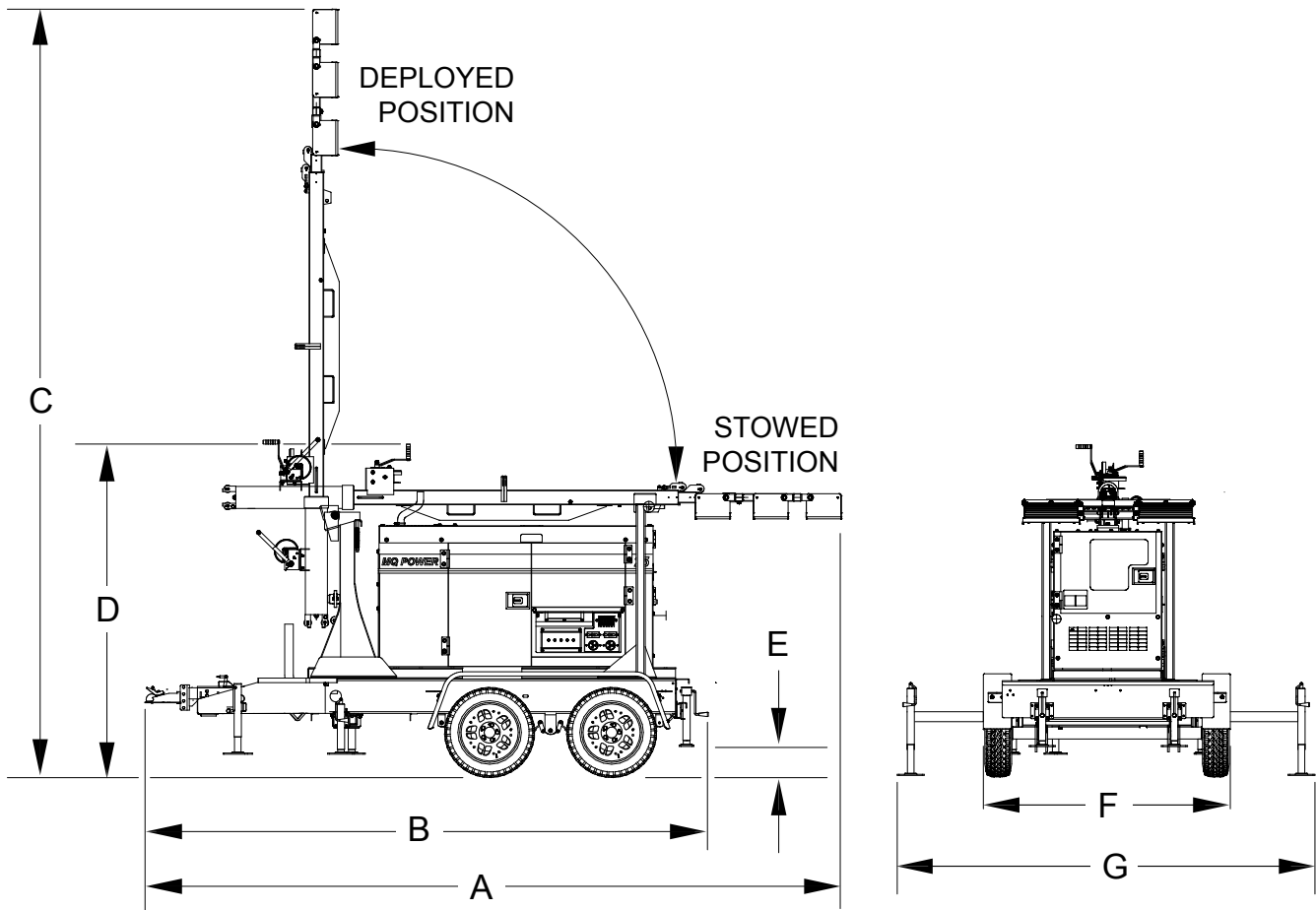


Figure 1. Dimensions

Table 2. Dimensions

Reference Letter	Description	Dimension
A	Length (Mast Stowed Position)	170 in. (431 cm.)
B	Length (Mast Deployed Position)	101 in. (256 cm.)
C	Max. Height (Mast Deployed Position)	31.5 ft. (9.6 m)
D	Height (Mast Stowed Position)	74 in. (187 cm.)
E	Ground Clearance (From Axle)	8 in. (20 cm.)
F	Width (Tow Ready)	51 in. (129 cm.)
G	Width (Outriggers Deployed)	109 in. (276 cm.)

GENERAL INFORMATION

The Multiquip MLT20 Series Light Tower is a dedicated general purpose light tower engineered to provide dependable lighting for a wide range of applications. This includes lighting for construction sites, industrial locations, special events, and emergency conditions.

METAL HALIDE LAMPS

The MLT20 Series Light Tower is available with 6 metal halide, 1000-watt lamps (MLT20DCA6) or with 4 metal halide, 1000-watt lamps (MLT20DCA). These lamps provide maximum illumination with typical lighting coverage of 5 to 7 acres. The lamps are controlled by individual circuit breakers for versatility.

ENGINE

The MLT20 Series Light Tower is powered by a diesel engine that is equipped with automatic shutdowns for low oil pressure, high coolant temperature, and alternator charge failure.

NOTICE

The illustrations in this manual show model MLT20DCA6 (with 6 lamps). However, information is also applicable to the MLT20DCA (with 4 lamps) unless stated otherwise.

STABILITY

The light tower can be raised vertically in excess of 31.5 feet (9.6 meters) by means of a manual winch. The tower tensioning system is designed to provide the necessary tension to safely control the pivot of the tower. The light tower has a wind stability of up to 65 mph with outriggers and jackstands fully deployed.

PANEL LIGHT

A panel light automatically illuminates the control panel and all functions when the engine access door is opened. This feature is convenient for night deployment.

TRAILER DESIGN

The trailer design of the MLT20 Series light tower withstands the rigors of the jobsite in addition to providing smooth highway towing.

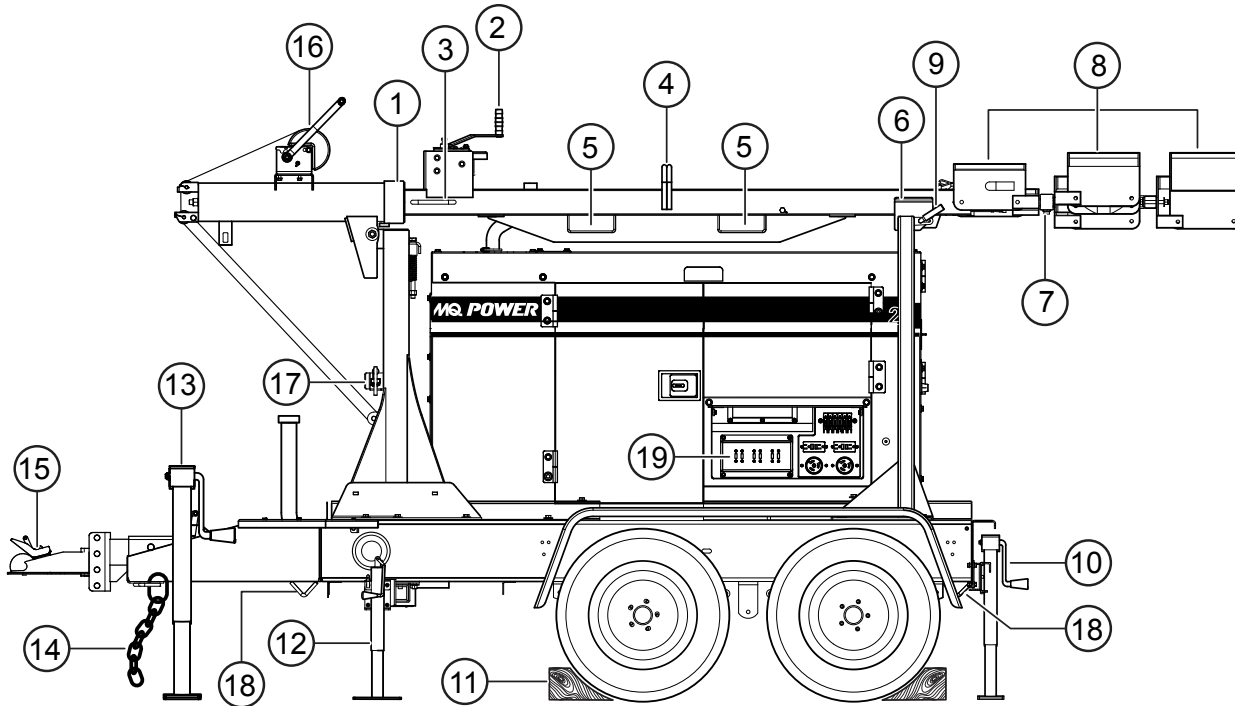


Figure 2. Major Components (Control Panel Side)

Figure 2 and Figure 3 show the location of the controls and components for the MLT20 Series light tower. The function of each control is described below.

1. **Mast Rotation Locking Knob** — Unscrew this knob to release mast for rotation. Tighten this knob to lock mast after it is set to the desired position.
2. **Mast Extension Winch** — Use this winch to extend the mast to the desired height. Maximum height is approximately 31.5 feet (9.6 meters).
3. **Mast Rotation Handles** — Grip these handles to rotate mast to desired position.
4. **Lifting Bale** — Light tower can be lifted using this lifting bale. The lifting bale is balanced for a fully configured light tower. Removal of any components will unbalance the lifting bale.
5. **Forklift Pockets** — Light tower can be lifted using these forklift pockets. Insert the forks of the forklift as far possible into the pockets.
6. **Mast Cradle Support** — When towing of the light tower is required, place the tower mast into the cradle support. Make sure cradle lock/release pin has been inserted and mast is locked.
7. **T-Bar** — Allows the lamps to be mounted vertically or horizontally.
8. **Lamps** — Six (MLT20DCA6) or Four (MLT20DCA) 1000-watt metal-halide bulbs with a 110,000 lumens capacity each.
9. **Cradle Lock/Release Pin** — Locks mast in cradle support and releases mast when removed.
10. **Rear Jackstands** — There are two jackstands located at the rear of the trailer. Use these jackstands to level and support the light tower.
11. **Chock Blocks** — Place these blocks (not included as part of the light tower package) under each trailer wheel to prevent rolling.
12. **Outrigger Jacks** — Use these 2 outrigger jacks to level and support the light tower. For more stability, the outriggers can be deployed.

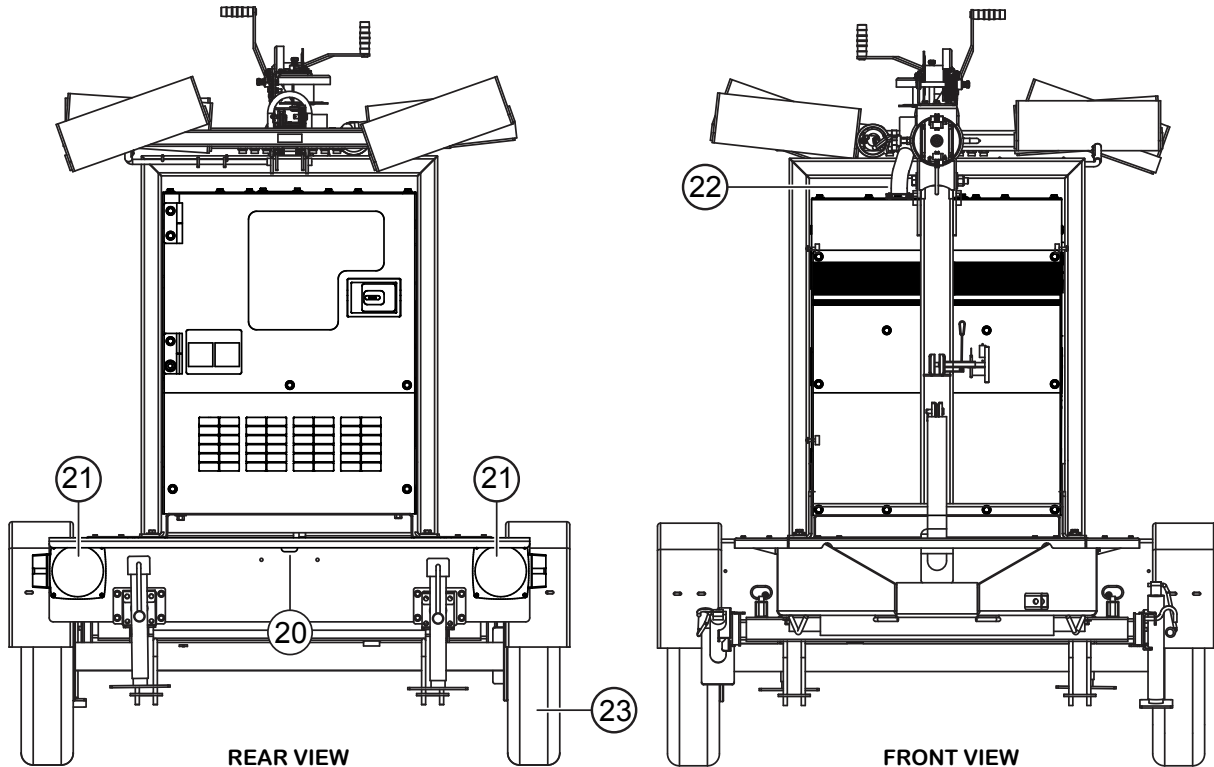


Figure 3. Major Components (Front/Rear)

13. **Tongue Jackstand** — Use this jackstand to support the tongue when attaching the light tower to a towing vehicle.
14. **Safety Chain** — Always attach safety chain to the towing vehicle. Never tow the light tower with the safety chain unattached.
15. **Ball Hitch Coupler** — Attach this coupler to the towing vehicle. Use only the specified ball diameter as indicated on your coupler. Use of any other ball diameter will create an extremely dangerous condition which can result in separation of the coupler and ball or ball failure.
16. **Vertical Mast Winch** — Use this winch to raise the mast to the vertical position.
17. **Mast Lock/Release Pin** — Pull this pin to start placing the tower mast in the vertical position. When tower mast has reached full vertical position, insert pin to keep mast from falling.
18. **Tie-Down Points** — Used to tie down light tower with strap or chains to allow even application of force to the front and rear of the equipment during transport.
19. **Circuit Breakers** — Turn the lamps on and off.
20. **License Light** — This light illuminates the license plate. Whenever towing of the light tower is required, make sure this light is operational.
21. **Brake Lights** — Before towing the light tower, make sure that these lights are operational and are working correctly. Never tow the light tower if these lights are inoperative.
22. **Engine Exhaust Pipe** — Directs engine exhaust to the rear of the light tower. **NEVER** block this exhaust pipe with obstructions. **ALWAYS** place the generator in an area free of obstructions.
23. **Tires** — This light tower uses ST205/75D15 LR-C size tire. Replace with only recommended tire size. Never tow light tower with bad or worn tires.

BEFORE STARTING

1. Read all safety instructions at the beginning of manual.
2. Clean the light tower, removing dirt and dust, particularly the engine cooling air inlet and air cleaner.
3. Check the air filter for dirt and dust. If air filter is dirty, replace air filter with a new one as required.
4. Check all fastening nuts and bolts for tightness.

WARNING



The engine's exhaust contains harmful emissions. **ALWAYS** ventilate the exhaust when operating inside tunnels, excavations or buildings. Direct exhaust away from nearby personnel.

Before starting the engine, make sure of the following:

- The electrical load is disconnected and the main circuit breaker and all lamp circuit breakers are switched to the OFF position.

CAUTION

NEVER start the engine with any circuit breakers in the ON position.

- Light tower is placed on secure level ground with chock blocks underneath each wheel to prevent the light tower from rolling.
- Outriggers have been fully extended to prevent the trailer from tipping.
- Light tower trailer support stands have been positioned properly and the trailer is level.
- Lamps have been adjusted to desired position.
- Chocked blocks have been positioned under each wheel to prevent trailer from rolling.
- Light tower trailer frame has been grounded correctly.
- Lamps do not interfere with any overhead obstructions.

DANGER

ALWAYS make sure the area above light tower is open and clear of overhead power lines and other obstructions. The tower extends in excess of 30 ft. (9 meters). Contact with overhead power lines or other obstructions could result in equipment damage, serious injury or death!

- Lamp power cables have been plugged into the appropriate receptacles (J1-J6) on the T-Bar assembly. Follow instructions below to correctly install the power cable plugs.

- a. Locate the 6 (4 for the MLT20DCA) key-lock, 3-pin, female connectors on the T-bar. See Figure 4.

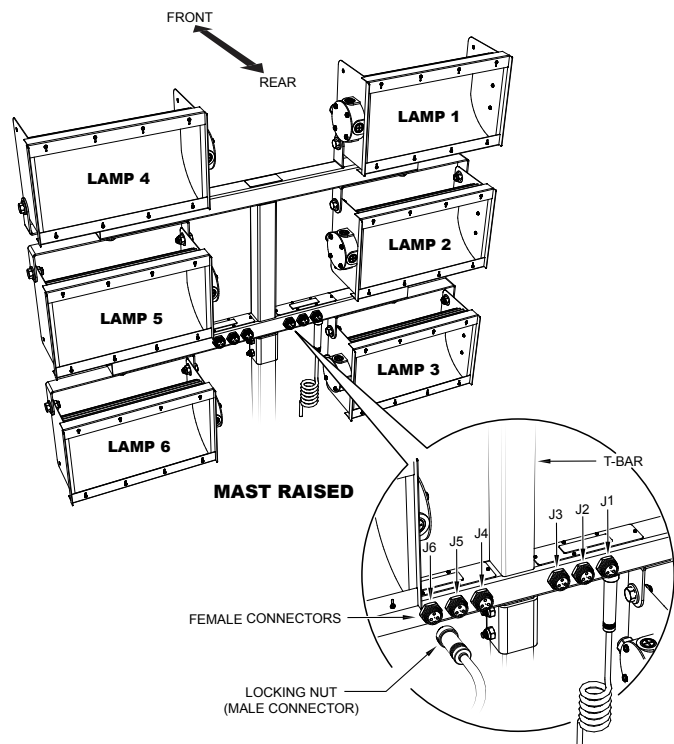


Figure 4. T-Bar and Cable Connectors

- b. Locate the key slot A on each female connector as shown in Figure 5.

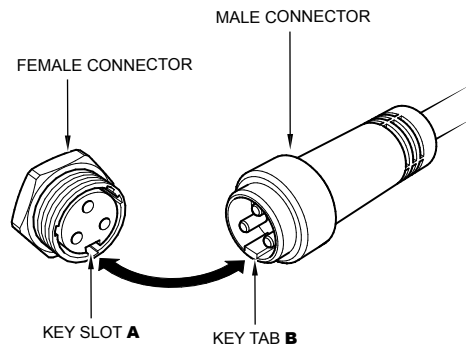


Figure 5. Female and Male Connector

- c. On the corresponding male connector, locate the key tab B as shown in Figure 5.
- d. Align the key tab B on the male connector with the key slot A on the female connector and press together until seated.
- e. Secure the connector by screwing the knurled locking nut of the male connector to the threaded portion of the female connector to ensure good contact between the two connectors.

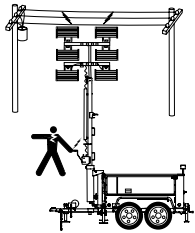
STARTING THE ENGINE

NOTICE

Refer to the accompanying DCA20SPXU2 generator operation and parts manual (Part Number 49840) for information on how to start the engine.

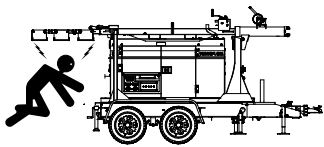
MAST OPERATION

! DANGER



ALWAYS make sure the area above light tower is open and clear of overhead power lines and other obstructions. The tower extends in excess of 30 feet (9 meters). Contact with overhead power lines or other obstructions could result in equipment damage, serious injury or death!

! DANGER



DO NOT stand behind the trailer while the mast is being raised or lowered. Serious injury could result if the mast falls down.

Outriggers and Support Stands

See Figure 6 for location of components.

1. Make sure both outriggers are extended. To extend the outriggers, pull the locking pin on the outrigger and hold while sliding out the outrigger assembly.

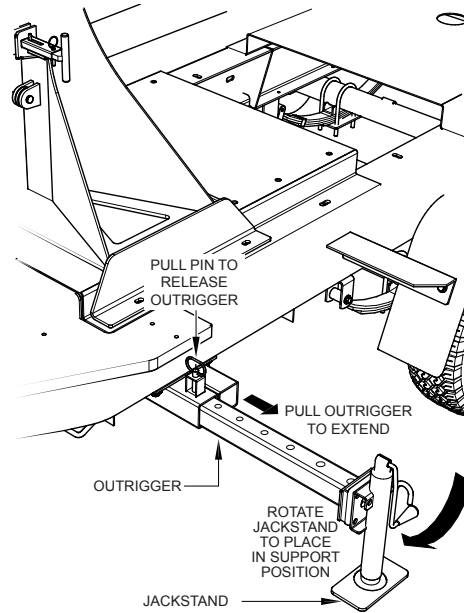


Figure 6. Deploying Outriggers

2. As soon as the pin clears the travel position hole, release it and continue sliding out the outrigger. The pin must snap into the outrigger locking hole in the extended position.
3. After extending all outriggers, rotate all trailer jack stands into the foot down position, then turn the crank handle on the jackstands clockwise to lower it and level the light tower.
4. Check behind the light tower and make sure all personnel and objects are clear of the mast.

Deploying the Mast to Vertical Position

Refer to Figure 7 for the location of components:

1. To release the mast from the mast cradle support, pull the retaining pin out of the cradle lock/release pin. Pull the cradle lock/release pin. This will unlock the mast from the horizontal position.
2. Remove the mast lock/release pin before raising tower to the vertical position.
3. To place the mast in the vertical position, turn the vertical mast winch hand lever clockwise until the mast is pointing upwards at 90 degrees.
4. Once the mast is in the vertical position, insert the mast lock/release pin to prevent the mast from falling.

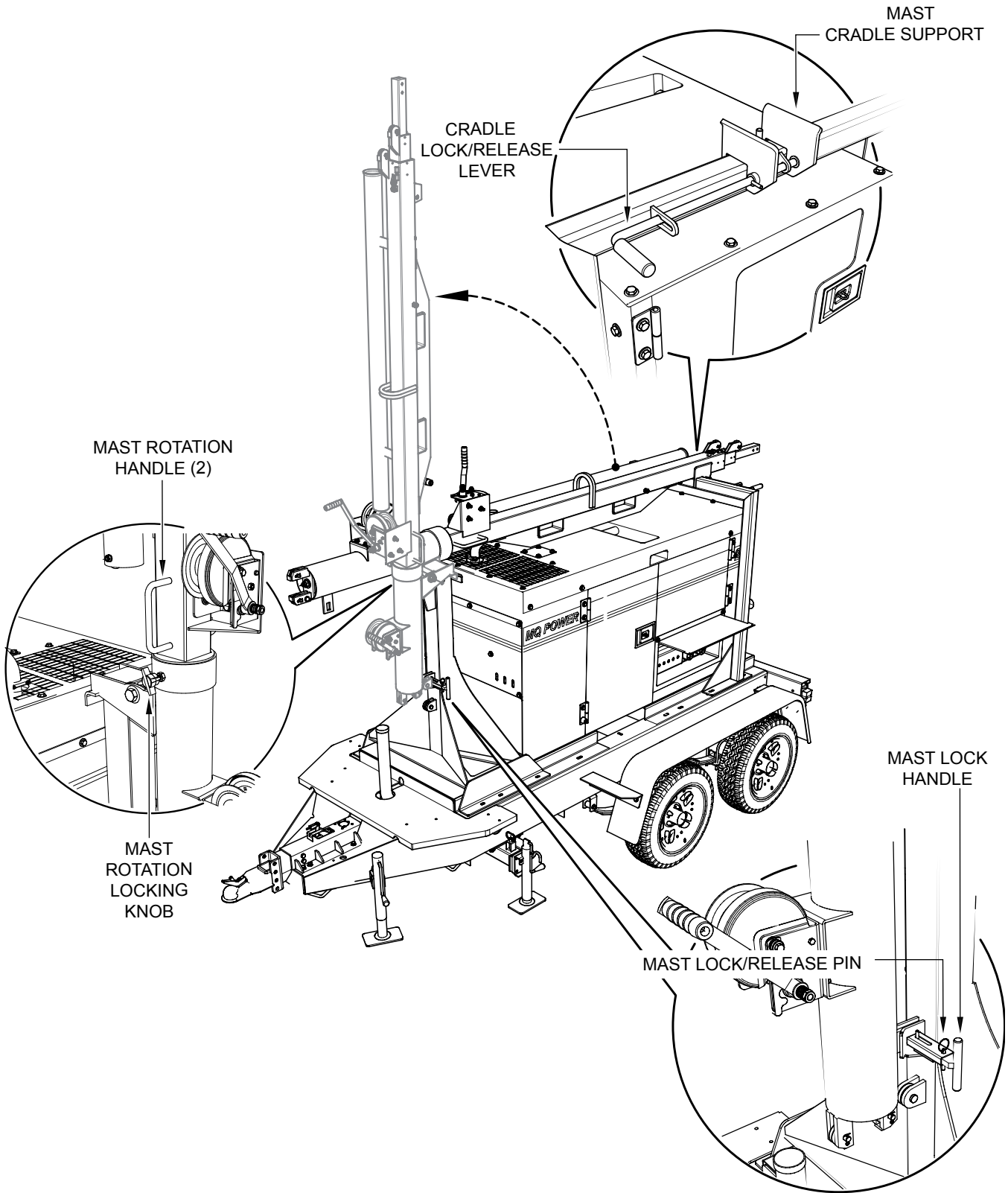


Figure 7. Raising the Mast

Raising the Mast

Once the tower mast has been locked into its vertical position, the mast can now be raised. The tower allows the lamps to be extended upwards in excess of 30 feet.

Refer to Figure 7 for location of components.

1. Turn the mast extension winch clockwise and observe that the mast begins to extend upwards.
2. Continue turning the winch in the clockwise direction until the desired height has been reached.
3. Release the winch. This winch is of the self-locking type. The tension on the cable will keep the mast in place.

Lowering the Mast

1. Turn the mast extension winch counterclockwise, and observe that the mast begins to lower.
2. Continue turning the winch counterclockwise until the mast has been fully retracted (slack in the cable).

Stowing the Mast to Horizontal Position

Refer to Figure 7 for the location of components:

1. Remove the mast lock/release pin to allow the mast section to be lowered to the horizontal position. Pull out the mast lock handle to unlatch.
2. Turn the vertical mast winch counterclockwise and observe that mast begins to approach the horizontal position. The mast lock handle can now be released.
3. Continue turning the vertical mast winch in the counterclockwise direction. As the mast approaches the mast cradle support, pull the retaining pin and then the cradle lock/release pin to allow the mast to rest in the cradle.
4. Once the mast is resting in the mast cradle support, insert the cradle lock/release pin and secure with retaining pin to keep mast in place.

Rotating the Mast

To change the direction that the lamps are facing, the mast can be rotated.

Refer to Figure 7 for the location of components.

1. With the mast in the deployed position (vertical), unscrew the mast rotation locking knob to release the mast for rotation.
2. Grip the mast rotation handles and rotate the mast until the lamps are facing the desired direction.
3. When the lamps are facing the desired direction, tighten the mast rotation lock knob to lock the mast in place.

TURNING ON THE LAMPS

Lamp circuit breakers (15 amps each) are located on the front of the light tower to turn the lamps on and off. See Table 3.

Circuit Breaker (ON)	Lamps (ON)
CB1	1
CB2	2
CB3	3
CB4	4
CB5	5
CB6	6

NOTICE

Model MLT20DCA has only 4 lamps and 4 circuit breakers.

1. Before turning on the lamps, make sure that main circuit breaker on the generator control panel and the circuit breakers shown in Figure 8 are all in the off position.

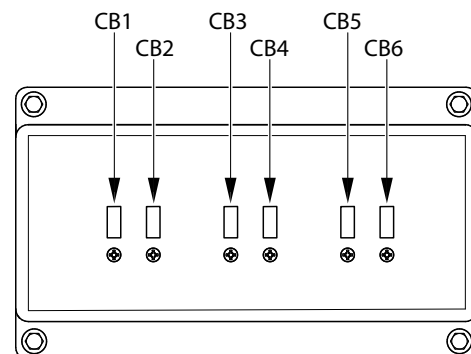


Figure 8. Lamp Circuit Breakers

OPERATION

- Adjust the Voltage Regulator Knob to 120VAC. Check the AC voltmeter for the correct reading. See Figure 9.

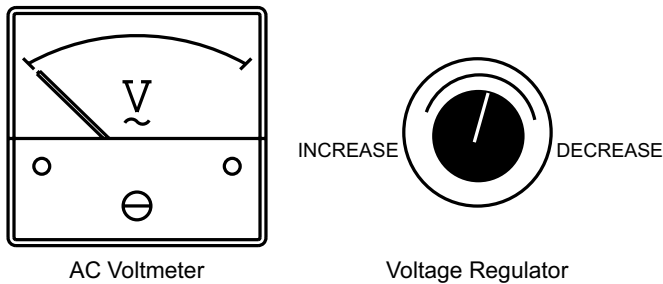


Figure 9. Voltage Regulator Knob and AC Voltmeter

- Switch the appropriate circuit breakers to the ON position for the lamps (Figure 10) that you want to turn on as detailed in Table 3.

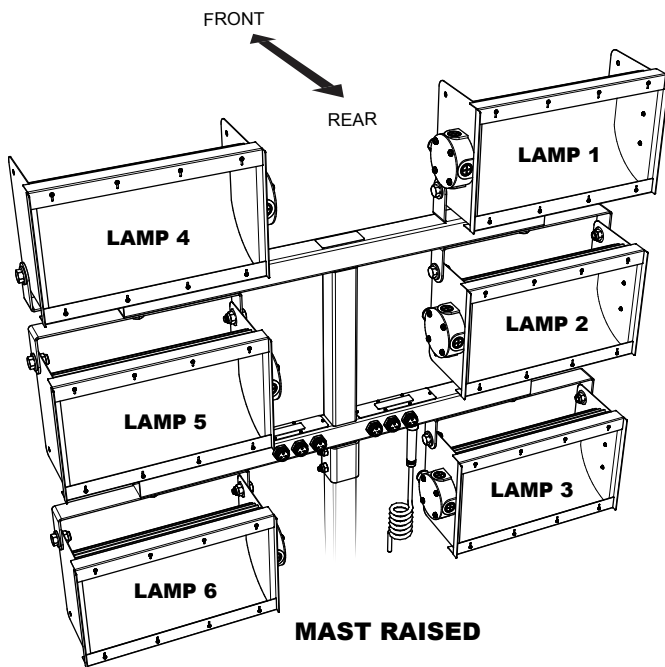


Figure 10. Lamp Orientation (MLTDCA6)

- When the lamps turn on, check the AC voltmeter reading and adjust the Voltage Regulator knob, if necessary, to correct the voltage.
- If any of the lamps do not turn on as they should, refer to the troubleshooting section of this manual.
- Close all cabinet doors after desired lights are on.

NOTICE

NEVER operate the light tower with the engine compartment doors open. Operation with the doors open may cause insufficient cooling to the unit, and damage may result.

MAINTENANCE

GENERAL INSPECTION

Prior to each use, the light tower should be cleaned and inspected. Check for loose, missing, or damaged nuts, bolts or other fasteners.

GENERATOR/ENGINE MAINTENANCE

Refer to the accompanying DCA20SPXU2 Operator and Parts Manual (Part Number 49840) for information on how to maintain the generator and engine.

CHECK CABLE WEAR

The wire rope (cable) that raises and extends the mast is a very important part of the light tower. There is one cable/hand winch system, located on the tongue of the trailer, that raises and extends the light tower mast. There is a second cable/hand winch system located on the mast that serves to raise and lower the two extendable sections of the mast.

DANGER

Wire rope (cable) will fail if it is worn, frayed, misused, crushed, kinked or damaged in any way. Always check the cables and pulleys for any abnormalities before use.

Do not use it if there is even the slightest cause for concern and replace any damaged cables or pulleys immediately.

SERVICING THE MAST RAISE/LOWER CABLE SYSTEM

To replace any components in the mast raise/lower cable system, use the following steps (See Figure 11):

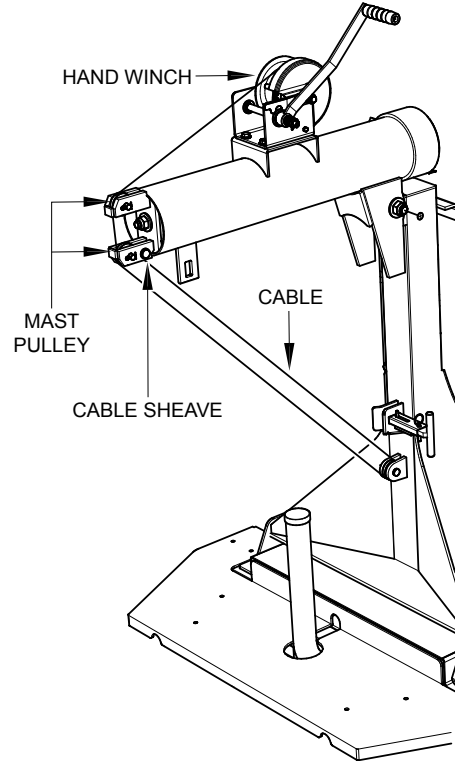


Figure 11. Mast Raise/Lower Cable System

1. Lower the mast to the horizontal resting position.
2. Inspect the cable clamps, pulleys, and other components for worn or damaged parts.
3. Disconnect the cable from the ball socket pin and remove from the mast pulley and cable sheave. Detach the cable from the hand winch as necessary.
4. Replace the pulley and the cable as needed.
5. Rethread the cable through the pulley and reattach the cable to the ball socket pin.
6. Raise and lower the mast several times to verify correct operation.

SERVICING THE MAST EXTENSION CABLE SYSTEM

To replace the cable in the mast extension cable system, use the following steps (See Figure 12):

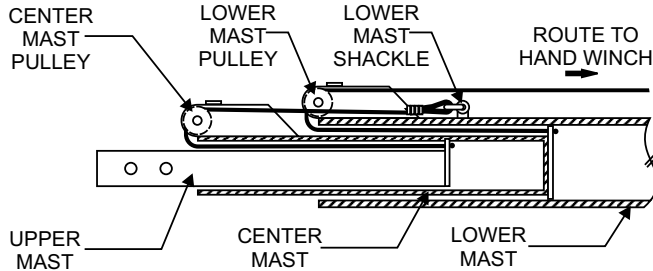


Figure 12. Mast Extension Cable System

1. Lower the mast to the horizontal resting position.
2. Inspect the cable clamps, pulleys, and other components for worn or damaged parts. If either of the cables on the mast needs to be replaced, they should both be replaced at the same time.
3. Disassemble the mast by disconnecting the cables from the mast and sliding the sections apart. The lower cable can be disconnected from the winch.
4. There are two pulleys in the mast raise/lower cable system. They should be removed and replaced if worn or damaged. Worn or damaged pulleys can cause premature cable failure.
5. Reassemble the mast extension cable system by connecting the cable to the bottom of the upper mast and sliding the upper mast into the opening of the center mast. Connect the second cable to the bottom of the center mast and slide the center mast into the opening of the lower mast, observing proper lifting techniques.
6. Route the upper mast cable through the center mast pulley and connect the free end of the cable to the lower mast ankle shackle. Route the center mast cable through the lower mast pulley and connect the free end of the cable to the hand winch at the bottom of the lower mast.
7. Raise, extend, retract and lower the mast several times to verify correct operation.

WARNING

The mast sections are heavy and awkward to handle. Use proper lifting devices and procedures when servicing the mast and its components.

MAINTENANCE — TRAILERS

The following trailer maintenance guidelines are intended to assist the operator in preventive maintenance.

TRAILER BRAKES

Properly functioning brake shoes and drums are essential to ensure safety. The brakes should be inspected the first 200 miles of operation. This will allow the brake shoes and drums to seat properly. After the first 200 mile interval, inspect the brakes every 3,000 miles. If driving over rough terrain, inspect the brakes more frequently.

HYDRAULIC BRAKES

If your trailer has hydraulic brakes, they function the same way the surge brakes do on your tow vehicle. The hydraulic braking system must be inspected at least as often as the brakes on the tow vehicle, but no less than once per year. This inspection includes an assessment of the condition and proper operation of the wheel cylinders, brake shoes, brake drums and hubs.

MANUALLY ADJUSTING THE BRAKES

Most axles are fitted with a brake mechanism that will adjust the brakes during a hard stop. However, some braking systems are not automatically adjusted by hard stopping. These brakes require manual adjustment. The following steps apply to adjust most manually adjustable brakes.

1. Jack up the trailer and secure it on adequate capacity jackstands.
2. Be sure the wheel and brake drum rotate freely.
3. Remove the adjusting-hole cover from the adjusting slot on the bottom of the brake backing plate.
4. With a screwdriver or standard adjusting tool, rotate the starwheel of the adjuster assembly to expand the brake shoes. Adjust the brake shoes out until the pressure of the linings against the drum makes the wheel very difficult to turn. Note: Your trailer maybe equipped with drop spindle axles. See axle manual for your axle type. You will need a modified adjusting tool for adjusting the brakes in these axles. With drop spindle axles, a modified adjusting tool with about an 80 degree angle should be used.
5. Rotate the starwheel in the opposite direction until the wheel turns freely with a slight drag.

6. Replace the adjusting-hole cover.
7. Repeat the above procedure on all brakes.
8. Lower the trailer to the ground.

Check the fluid level in the master cylinder reservoir at least every three months. If you tow your trailer an average of 1,000 miles per month in a hot and dry environment, you must check the brake fluid level once a month. The brake fluid reservoir is located on the tongue of the trailer. Always fill with clean, uncontaminated DOT 4 brake fluid.

Figure 13 below displays the major hydraulic brake components that will require inspection and maintenance. Please inspect these components as required using steps 1 through 6 as referenced in the “Manually Adjusting The Brakes” section on this page. See Table 4 for Hydraulic Brake Troubleshooting.

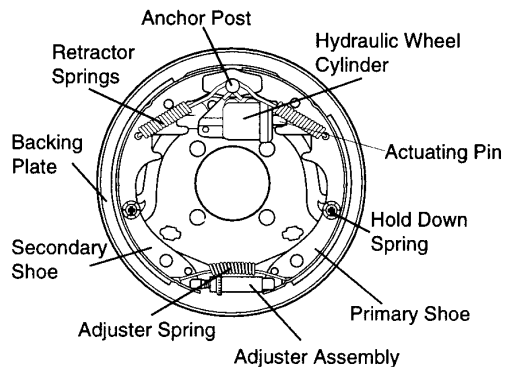


Figure 13. Hydraulic Brake Components

HYDRAULIC BRAKE ACTUATOR

The hydraulic brake actuator (Figure 14) is the mechanism that activates the trailer's brake system. This actuator changes fluid power into mechanical power. Therefore, the fluid level must be checked frequently to assure that the brakes function properly.

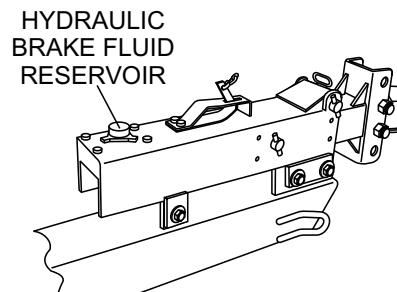


Figure 14. Hydraulic Brake Actuator

⚠ WARNING

Failure to maintain proper fluid level in the actuator may result in loss of braking action which could cause severe property damage, injury or death.

Periodically check the actuator mounting fasteners for damage or loosening. Inspect the actuator for worn or damaged parts. As you are towing your trailer, be aware of any changes in braking quality. This could be an early warning of brake or actuator malfunction and requires immediate attention. Consult a certified brake specialist to make necessary adjustment or repairs.

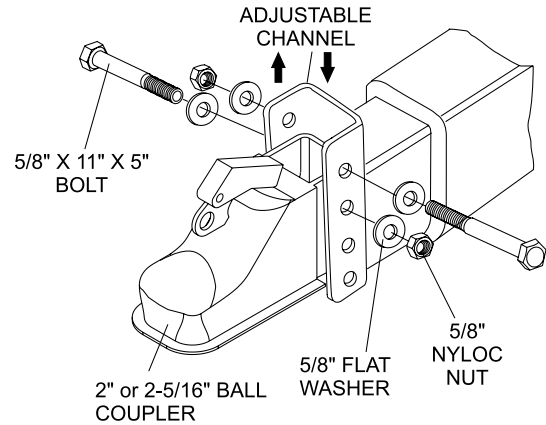


Figure 15. Adjustable Channel

Table 4. Hydraulic Brake Troubleshooting		
Symptom	Possible Cause	Solution
No Brakes	Brake line broken or kinked?	Repair or replace.
Weak Brakes or Brakes Pull to One Side	Brake lining glazed?	Reburnish or replace.
	Trailer overloaded?	Correct weight.
	Brake drums scored or grooved?	Machine or replace.
	Tire pressure correct?	Inflate all tires equally.
	Tires unmatched on the same axle?	Match tires.
Locking Brakes	Brake components loose, bent or broken?	Replace components.
	Brake drums out-of-round?	Replace.
Noisy Brakes	System lubricated?	Lubricate.
	Brake components correct?	Replace and correct.
Dragging Brakes	Brake lining thickness incorrect or not adjusted correctly?	Install new shoes and linings.
	Enough brake fluid or correct fluid?	Replace rubber parts fill with dot 4 fluid.

ADJUSTABLE CHANNEL

Your trailer may be equipped with an adjustable channel (Figure 15) that allows the coupler to be raised or lowered to a desired height. Periodically check the channel bolts for damage or loosening.

NOTICE

When replacing channel mounting hardware (nuts, bolts and washers), **never** substitute substandard hardware. Pay close attention to **bolt length** and **grade**. **ALWAYS** use manufacturer's recommended parts when replacing channel mounting hardware.

Wheel Bearings

Wheel bearings (Figure 16) must be inspected and lubricated once a year or 12,000 miles to insure safe operation of your trailer.

If trailer wheel bearings are immersed in water, they must be replaced.

⚠ DANGER

If trailer wheels are under water for a long period of time, wheel bearings may fail. If this is the case, service wheel bearings immediately.

The possibility exists of the wheels falling off causing equipment damage and severe bodily harm even death!

If the trailer has not been used for an extended amount of time, have the bearings inspected and packed more frequently, at least every six months and prior to use.

Follow the steps below to disassemble the wheel hub and service the wheel bearings. See Figure 16.

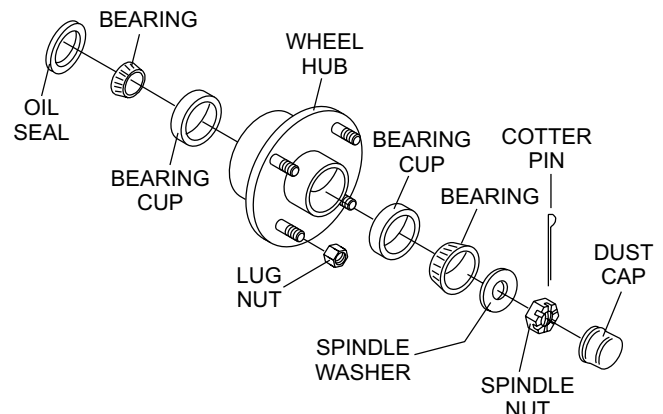


Figure 16. Wheel Hub Components

MAINTENANCE — TRAILERS

- After removing the dust cap, cotter pin, spindle nut and spindle washer, remove the hub to inspect the bearings for wear and damage.
- Replace bearings that have flat spots on rollers, broken roller cages, rust or pitting. Always replace bearings and cups in sets. The inner and outer bearings are to be replaced at the same time.
- Replace seals that have nicks, tears or wear.
- Lubricate the bearings with a high quality EP-2 automotive wheel bearing grease.

WHEEL HUB ADJUSTMENT

Every time the wheel hub is removed and the bearings are reassembled, follow the steps below to check the wheel bearings for free running and adjust.

- Turn the hub slowly, by hand, while tightening the spindle nut until you can no longer turn the hub by hand.
- Loosen the spindle nut just until you are able to turn it (the spindle nut) by hand. Do not turn the hub while the spindle nut is loose.
- Install a new cotter pin through the spindle nut and axle.
- Check the adjustments. Both the hub and the spindle nut should be able to move freely (the spindle nut motion will be limited by the cotter pin).

! DANGER

NEVER crawl under the trailer unless it is on firm and level ground and resting on properly placed and secured jackstands.

The possibility exists of the trailer falling thus causing equipment damage and severe bodily harm even death!

! DANGER

When performing trailer inspection and maintenance activities, you must jack up the trailer using jacks and jackstands.

When jacking and using jackstands, place them so as to clear wiring, brake lines, and suspension parts (i.e., springs, torsion bars). Place jacks and jackstands inside of the perimeter strip on the supporting structure to which the axles are attached.

! DANGER

Improper weld repair will lead to early failure of the trailer structure and can cause serious injury or death.

DO NOT repair cracked or broken welds unless you have a certified welder perform the repair. If not, have the welds repaired by your dealer.

! WARNING

If the trailer is involved in an accident, have it inspected immediately by qualified personnel. In addition, the trailer should be inspected annually for signs of wear or deformations.

LEAF SUSPENSION

The leaf suspension springs and associated components (Figure 17) should be visually inspected every 6,000 miles for signs of excessive wear, elongation of bolt holes, and loosening of fasteners. Replace all damaged parts (suspension) immediately.

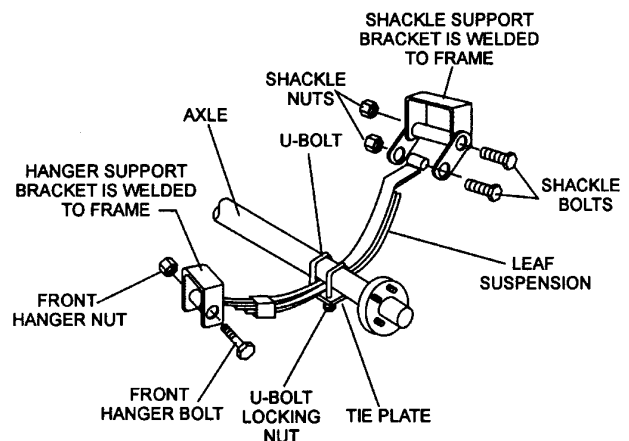


Figure 17. Leaf Suspension Components

! DANGER

Worn or broken suspension parts can cause loss of control, damage to equipment and severe bodily injury, even death!

Check suspension regularly.

SAFETY GUIDELINES — TRAILERS

The following guidelines are intended to assist the operator in the operation and handling of a trailer.

Safety precautions should be followed at all times when operating a trailer. Failure to read, understand and follow the safety guidelines could result in injury to yourself and others. Loss of control of the trailer or tow vehicle can result in death or serious injury.

COMMON CAUSES FOR LOSS OF TRAILER

- Driving too fast for the conditions (maximum speed when towing a trailer is 55 mph).
- Overloading the trailer or loading the trailer unevenly.
- Trailer improperly coupled to the hitch.
- No braking on trailer.
- Not maintaining proper tire pressure.
- Not keeping lug nuts tight.
- Not properly maintaining the trailer structure.
- Ensure machine is towed level to tow vehicle.

TRAILER TOWING GUIDELINES

- Recheck the load tiedowns to make sure the load will not shift during towing.
- Before towing, check coupling, safety chain, safety brake, tires, wheels and lights.
- Check the lug nuts or bolts for tightness.
- Check coupler tightness after towing 50 miles.
- Use your mirrors to verify that you have room to change lanes or pull into traffic.
- Use your turn signals well in advance. Allow plenty of stopping space for your trailer and tow vehicle.
- Allow plenty of stopping space for your trailer and tow vehicle.
- **DO NOT** drive so fast that the trailer begins to sway due to speed.
- Allow plenty of room for passing. A rule of thumb is that the passing distance with a trailer is 4 times the passing distance without the trailer.

- Shift your automatic transmission into a lower gear for city driving.
- **ALWAYS** use lower gears for climbing and descending grades.
- **DO NOT** ride the brakes while descending grades, they may get so hot that they stop working. Then you will potentially have a runaway tow vehicle and trailer.
- To conserve fuel, don't use full throttle to climb a hill. Instead, build speed on the approach.
- Slow down for bumps in the road. Take your foot off the brake when crossing the bump.
- **DO NOT** brake while in a curve unless absolutely necessary. Instead, slow down before you enter the curve and power through the curve. This way, the towing vehicle remains in charge.
- **DO NOT** apply the brakes to correct extreme trailer swaying. Continued pulling of the trailer, and even slight acceleration, will provide a stabilizing force.
- Anticipate the trailer "swaying." Swaying is the trailer reaction to the air pressure wave caused by passing trucks and buses. Continued pulling of the trailer provides a stabilizing force to correct swaying. **DO NOT** apply the brakes to correct trailer swaying.
- Use lower gear when driving down steep or long grades. Use the engine and transmission as a brake. Do not ride the brakes, as they can overheat and become ineffective.
- Be aware of your trailer height, especially when approaching roofed areas and around trees.
- Make regular stops, about once each hour. Confirm that:
 - Coupler is secure to the hitch and is locked.
 - Electrical connectors are secure.
 - There is appropriate slack in the safety chains.
 - There is appropriate slack in the breakaway switch pullpin cable.
 - Tires are not visibly low on pressure.

SAFETY GUIDELINES — TRAILERS

DRIVING CONDITIONS

When towing a trailer, you will have decreased acceleration, increased stopping distance, and increased turning radius (which means you must make wider turns to keep from hitting curbs, vehicles, and anything else that is on the inside corner). In addition, you will need a longer distance to pass, due to slower acceleration and increased length.

- Be alert for slippery conditions. You are more likely to be affected by slippery road surfaces when driving a tow vehicle with a trailer, than driving a tow vehicle without a trailer.
- Check rearview mirrors frequently to observe the trailer and traffic.
- **NEVER** drive faster than what is safe.

WARNING

Driving too fast for severe road conditions can result in loss of control and cause death or serious injury.

Decrease your speed as road, weather, and lighting conditions deteriorate.

Always check for local trailer tow speed limits in your area.

WARNING

Do not transport people on the trailer. The transport of people puts their lives at risk and may be illegal.

COUPLING TO THE TOW VEHICLE

Follow all of the safety precautions and instructions in this manual to ensure safety of persons, equipment, and satisfactory life of the trailer. Always use an adequate tow vehicle and hitch. If the vehicle or hitch is not properly selected and matched to the Gross Vehicle Weight Rating (GVWR) of your trailer, you can cause an accident that could lead to death or serious injury.

If you already have a tow vehicle, know your vehicle tow rating and make certain the trailer's rated capacity is less than or equal to the tow vehicle's rated towing capacity. If you already have (or plan to buy) a trailer, make certain that the tow rating of the tow vehicle is equal to or greater than that of the trailer.

The trailer VIN tag contains the critical safety information

for the use of your trailer. Again, be sure your hitch and tow vehicle are rated for the Gross Vehicle Weight Rating of your trailer.

WARNING

Proper selection and condition of the coupler and hitch are essential to safely towing your trailer. A loss of coupling may result in death or serious injury.

- Be sure the hitch load rating is equal to or greater than the load rating of the coupler.
- Be sure the hitch size matches the coupler size.
- Observe the hitch for wear, corrosion and cracks before coupling. Replace worn, corroded or cracked hitch components before coupling the trailer to the tow vehicle.
- Be sure the hitch components are tight before coupling the trailer to the tow vehicle.

WARNING

An improperly coupled trailer can result in death or serious injury.

DO NOT move the trailer until:

- The coupler is secured and locked to hitch.
- The safety chains are secured to the tow vehicle.
- The trailer jack(s) are fully retracted.

DO NOT tow the trailer on the road until:

- Tires and wheels are checked.
- The trailer brakes are checked.
- The breakaway switch is connected to the tow vehicle.
- The load is secured to the trailer.
- The trailer lights are connected and checked.

WARNING

Use of a hitch with a load rating less than the load rating of the trailer can result in loss of control and may lead to death or serious injury.

Use of a tow vehicle with a towing capacity less than the load rating of the trailer can result in loss of control, and may lead to death or serious injury.

Be sure your hitch and tow vehicle are rated for the Gross Vehicle Weight Rating of your trailer.

SAFETY GUIDELINES — TRAILERS

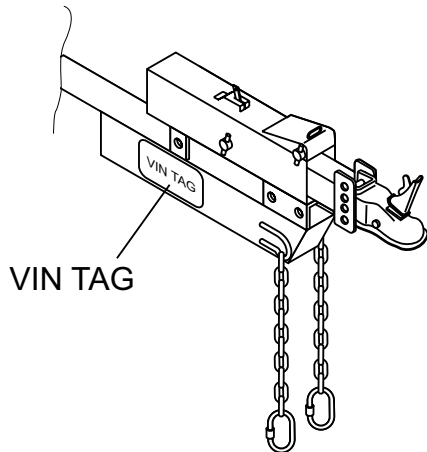


Figure B. VIN Tag Location

The trailer VIN Tag contains the following critical safety information for the use of your trailer.

GAWR: The maximum gross weight that an axle can support. It is the lowest of axle, wheel, or tire rating.

Usually, the tire or wheel rating is lower than the axle rating, and determines GAWR.

GVWR: The maximum allowable gross weight of the trailer and its contents. The gross weight of the trailer includes the weight of the trailer and all of the items within it. GVWR is sometimes referred to as GTWR (Gross Trailer Weight Rating), or MGTW (Maximum Gross Trailer Weight). GVWR, GTWR and MGTW are all the same rating.

The sum total of the GAWR for all trailer axles may be less than the GVWR for the trailer, because some of the trailer load is to be carried by the tow vehicle, rather than by the trailer axle(s). The total weight of the cargo and trailer must not exceed the GVWR, and the load on an axle must not exceed its GAWR.

PSIC: The tire pressure (psi) measured when cold.

VIN: The Vehicle Identification Number.

EMPTY WEIGHT: Some information that comes with the trailer (such as the Manufacturer's Statement of Origin) is not a reliable source for "empty" or "net" weight. The shipping documents list average or standard weights and your trailer may be equipped with options.

To determine the "empty" or "net" weight of your trailer, weigh it on an axle scale. To find the weight of the trailer using an axle scale, you must know the axle weights of your tow vehicle without the trailer coupled. Some of the trailer weight will be transferred from the trailer to the tow vehicle axles, and an axle scale weighs all axles, including the tow vehicle axles.

TOW VEHICLE

The towing hitch attached to your tow vehicle must have a capacity equal to or greater than the load rating of the trailer you intend to tow. The hitch capacity must also be matched to the tow vehicle capacity. Your vehicle dealer can provide and install the proper hitch on your tow vehicle.

SUSPENSION SYSTEM

Sway bars, shock absorbers, heavy duty springs, heavy duty tires and other suspension components may be required to sufficiently tow the trailer and pump.

BRAKE CONTROLLER

For trailers equipped with electric brakes, the electric brake controller is part of the tow vehicle and is essential in the operation of the electric brakes on the trailer. The brake controller is not the same as the safety breakaway brake system that may be equipped on the trailer.

SIDE VIEW MIRRORS

The size of the trailer that is being towed and your state law regulations determine the size of the mirrors. However, some states prohibit extended mirrors on a tow vehicle, except while a trailer is actually being towed. In this situation, detachable extended mirrors are necessary. Check with your dealer or the appropriate state agency for mirror requirements.

HEAVY DUTY FLASHER

A Heavy Duty Flasher is an electrical component that may be required when your trailer turn signal lights are attached to the tow vehicle flasher circuit.

ELECTRICAL CONNECTOR

An Electrical Connector connects the light and brake systems on the trailer to the light and brake controls on the towing vehicle.

SAFETY GUIDELINES — TRAILERS

EMERGENCY FLARES AND TRIANGLE REFLECTORS

It is wise to carry these warning devices even if you are not towing a trailer. It is particularly important to have these when towing a trailer because the hazard flashers of your towing vehicle will not operate for as long a period of time when the battery is running both the trailer lights and tow vehicle lights.

SAFETY CHAINS

If the coupler connection comes loose, the safety chains can keep the trailer attached to the tow vehicle. With properly rigged safety chains, it is possible to keep the tongue of the trailer from digging into the road pavement, even if the coupler-to-hitch connection comes apart.

TRAILER LIGHTING AND BRAKING CONNECTOR

A device that connects electrical power from the tow vehicle to the trailer. Electricity is used to turn on brake lights, running lights, and turn signals as required. In addition, if your trailer has a separate braking system, the electrical connector will also supply power to the brakes from the tow vehicle.

BREAKAWAY SYSTEM

If the trailer coupler connection comes loose, the breakaway system can actuate emergency hydraulic brakes depending on the type of actuator on the trailer. The breakaway cable must be rigged to the tow vehicle with appropriate slack that will activate the system if the coupler connection comes loose.

JACKSTAND

A device on the trailer that is used to raise and lower the coupler. The jack is sometimes called the “landing gear” or the “tongue jack”.

COUPLER TYPES

Two types of coupler used with the trailer are discussed below.

- Ball Hitch Coupler
- Pintel Eye Coupler

BALL HITCH COUPLER

A ball hitch coupler (Figure C) connects to a ball that is located on or under the rear bumper of tow vehicle. This system of coupling a trailer to a tow vehicle is sometimes referred to as “bumper pull.”

A ball hitch trailer may be fitted with a tongue jack that can raise and lower the coupler. The tongue jack is mounted to the A-frame (front or tongue) part of the trailer. By rotating the jack handle clockwise, the jack will extend and raise the tongue of the trailer.

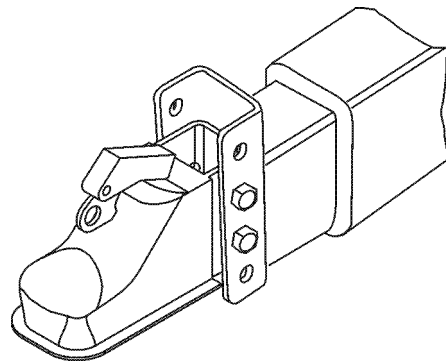


Figure C. Ball Hitch Coupler

Before each tow, coat the ball with a thin layer of automotive bearing grease to reduce wear and ensure proper operation. Check the locking device that secures the coupler to the ball for proper operation.

If you see or feel evidence of wear, such as flat spots, deformations, pitting or corrosion, on the ball or coupler, immediately have your dealer inspect them to determine the proper action to prevent possible failure of the ball and coupler system. All bent or broken coupler parts must be replaced before towing the trailer.

The coupler handle lever must be able to rotate freely and automatically snap into the latched position. Oil the pivot points, sliding surfaces, and spring ends with SAE 30W motor oil. Keep the ball socket and latch mechanism clean. Dirt or contamination can prevent proper operation of the latching mechanism.

The load rating of the coupler and the necessary ball size are listed on the trailer tongue. You must provide a hitch and ball for your tow vehicle where the load rating of the hitch and ball is equal to or greater than that of your trailer.

Also, the ball size must be the same as the coupler size. If the hitch ball is too small, too large, is underrated, is loose

SAFETY GUIDELINES — TRAILERS

or is worn, the trailer can come loose from the tow vehicle and may cause death or serious injury.

THE TOW VEHICLE, HITCH AND BALL MUST HAVE A RATED TOWING CAPACITY EQUAL TO OR GREATER THAN THE TRAILER **Gross Vehicle Weight Rating (GVWR)**. IT IS ESSENTIAL THAT THE HITCH BALL BE OF THE SAME SIZE AS THE COUPLER.

The ball size and load rating (capacity) are marked on the ball. Hitch capacity is marked on the hitch.

⚠ WARNING

Coupler-to-hitch mismatch can result in uncoupling, leading to death or serious injury.

Be sure the **LOAD RATING** of the hitch ball is equal or greater than the load rating of the coupler.

Be sure the **SIZE** of the hitch ball matches the size of the ball coupler.

⚠ WARNING

A worn, cracked or corroded hitch ball can fail while towing and may result in death or serious injury.

Before coupling trailer, inspect the hitch ball for wear, corrosion and cracks.

Replace worn or damaged hitch ball.

⚠ WARNING

A loose hitchball nut can result in uncoupling, leading to death or serious injury.

Be sure the hitch ball is tight to the hitch before coupling the trailer.

- Rock the ball to make sure it is tightened to the hitch, and visually check that the hitch ball nut is solid against the lock washer and hitch frame.
- Wipe the inside and outside of the coupler. Clean and visually inspect it for cracks and deformations. Feel the inside of the coupler for worn spots and pits.
- Be sure the coupler is secured tightly to the tongue of the trailer. All coupler fasteners must be visibly solid against the trailer frame.
- The bottom surface of the coupler must be above the top of the hitch ball. Use the tongue jackstand to support

the trailer tongue. Wood or concrete blocks may also be used.

Coupling the Trailer to the Tow Vehicle (Ball Coupler)

- Lubricate the hitch ball and the inside of the coupler with a thin layer of automotive bearing grease.
- Slowly back up the tow vehicle so that the hitch ball is near or aligned under the coupler.
- Using the jackstand at the front of trailer (tongue), turn the jackstand crank handle to raise the trailer. If the ball coupler does not line up with the hitch ball, adjust the position of the tow vehicle.
- Open the coupler locking mechanism. Ball couplers have a locking mechanism with an internal moving piece and an outside handle. In the open position, the coupler is able to drop fully onto the hitch ball.
- Lower the trailer (Figure D) until the coupler fully engages the hitch ball.

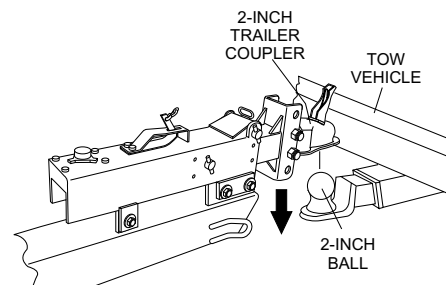


Figure D. Ball Hitch Coupling Mechanism

- Engage the coupler locking mechanism. In the engaged position, the locking mechanism securely holds the coupler to the hitch ball.
- Insert a pin or lock through the hole in the locking mechanism.
- Be sure the coupler is all the way on the hitch ball and the locking mechanism is engaged. A properly engaged locking mechanism will allow the coupler to raise the rear of the tow vehicle. Using the trailer jackstand, verify that you can raise the rear of the tow vehicle by 1 inch after the coupler is locked to the hitch.
- Lower the trailer so that its entire tongue weight is held by the hitch.
- Raise the jackstand to a height where it will not interfere with the road.

SAFETY GUIDELINES — TRAILERS

NOTICE

Overloading can damage the tongue jack. **DO NOT** use the tongue jack to raise the tow vehicle more than one inch.

If the coupler cannot be secured to the hitch ball, do not tow the trailer. Call your dealer for assistance. Lower the trailer so that its entire tongue weight is held by the hitch and continue retracting the jack to its fully retracted position.

Attaching Safety Chain

Visually inspect the safety chains and hooks for wear or damage. Replace worn or damaged safety chains and hooks before towing.

Attach the safety chains so that they:

- Cross underneath the coupler. See Figure E.

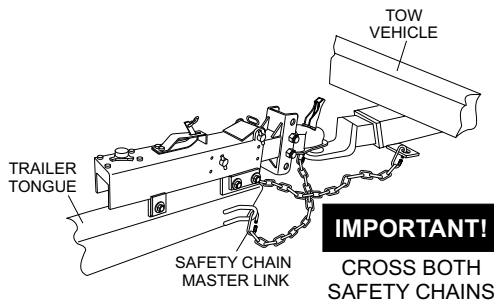


Figure E. Attaching Safety Chain (Ball Hitch)

- Loop around a frame member of the tow vehicle or holes provided in the hitch system (DO NOT attach them to an interchangeable part of the hitch assembly).
- Have enough slack to permit tight turns, but not be close to the road surface, so if the trailer uncouples, the safety chains can hold the tongue up above the road

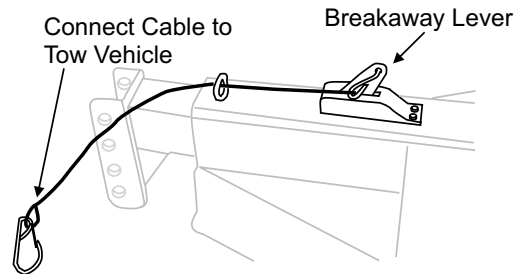
WARNING

Improper rigging of the safety chains can result in loss of control of the trailer and tow vehicle, leading to death or serious injury, if the trailer uncouples from the tow vehicle.

- Fasten chains to frame of tow vehicle. DO NOT fasten chains to any part of the hitch unless the hitch has holes or loops specifically for that purpose.
- Cross chains underneath hitch and coupler with enough slack to permit turning and to hold tongue up, if the trailer comes loose.

Breakaway Brake System

If the coupler or hitch fails, a properly connected and working breakaway brake system (Figure F) will apply the hydraulic brakes on the trailer. The safety chains will keep the tow vehicle attached and as the brakes are applied at the trailer's axles, the trailer/tow vehicle combination will come to a controlled stop.



Hydraulic Actuator

Figure F. Breakaway Brake System

Breakaway Cable Surge Brake System

The breakaway brake system includes a brake cable connected to the tow vehicle on one end and to the emergency brake lever located on the hydraulic actuator on the other end.

WARNING

- An ineffective breakaway brake system can result in a runaway trailer, leading to death or serious injury, if the coupler or ball hitch fails.
- Connect the breakaway cable to the tow vehicle and NOT to the hitch, ball or support.
- Before towing the trailer, test the function of the breakaway brake system. If the breakaway brake system is not working, DO NOT tow the trailer. Have it serviced or repaired.

NOTICE

DO NOT tow the trailer with the breakaway brake system ON because the brakes will overheat which can result in permanent brake failure.

NOTICE

Replace the breakaway brake battery (if equipped) at intervals specified by manufacturer.

SAFETY GUIDELINES — TRAILERS

Connecting Trailer Lights

Connect the trailer lights to the tow vehicle's electrical system using the electric connectors at the front of the trailer (tongue). Refer to the wiring diagram shown in the trailer wiring diagram section of this manual. Before towing the trailer check for the following:

- Running lights (turn on tow vehicle headlights).
- Brake Lights (step on tow vehicle brake pedal).
- Backup Lights (place tow vehicle gear shift in reverse).
- Turn Signals (activate tow vehicle directional signal lever).

WARNING

Improper electrical connection between the tow vehicle and the trailer will result in inoperable lights and electric brakes, and can lead to collision.

Before each tow:

- Check that the taillights, brake lights and turn signals work.
- Check that the electric brakes work by operating the brake controller inside the tow vehicle.

Uncoupling the Ball Hitch

Follow these steps to uncouple ball hitch from tow vehicle:

- Block trailer tires to prevent the trailer from rolling, before jacking the trailer up.
- Disconnect the electrical connector.
- Disconnect the breakaway brake switch cable. Promptly replace the pullpin in the switchbox.
- Before extending jackstand, make certain the ground surface below the jackstand foot will support the tongue load.
- Rotate the jackstand handle (or crank) clockwise. This will slowly extend the jack and transfer the weight of the trailer tongue to the jack.

PINTLE HITCH COUPLER

A pintle eye coupler (Figure G) connects to a pintle-hook hitch that is located on or under the rear bumper of the tow vehicle. This system of coupling a trailer to a tow vehicle is sometimes referred to as a "lunette eye, tow ring or G.I. hitch."

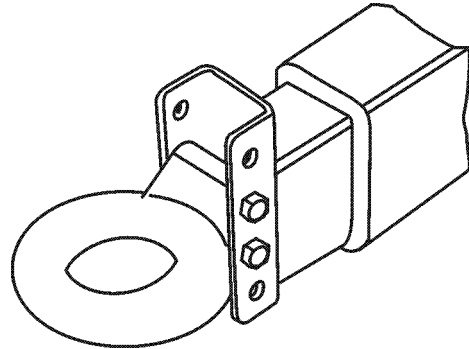


Figure G. Pintle Hitch Coupler

A pintle hitch trailer may be fitted with a tongue jackstand that can raise and lower the coupler. The tongue jack is mounted to the A-frame (front or tongue) part of the trailer. By rotating the jack handle clockwise, the jack will extend and raise the tongue of the trailer.

The load rating of the coupler and the necessary pintle hitch size are listed on the trailer tongue. You must provide a pintle hitch and pintle coupler for your tow vehicle, where the load rating of the pintle hitch and pintle coupler is equal to or greater than that of your trailer.

Also, the pintle hitch size must be the same as the pintle coupler size. If the hitch is too small, too large, underrated, loose or worn, the trailer can come loose from the tow vehicle, and may cause death or serious injury.

Pintle Coupler and Pintle Hook

Before each tow, check the locking device that secures the coupler to the pintle hook assembly.

The pintle hook lever must be able to operate freely and automatically snap into place into the latched position. Lightly oil the pivot points and sliding surfaces with SAE30W motor oil to prevent rust and help ensure proper operation of the latching mechanism.

If you see or feel evidence of wear, such as flat spots, deformations, pitting or corrosion, on the pintle hook or coupler, immediately have your dealer inspect them to determine the proper action to prevent possible failure of

SAFETY GUIDELINES — TRAILERS

the ball and coupler system. All bent or broken coupler parts must be replaced before towing the trailer.

THE TOW VEHICLE, PINTLE HITCH AND PINTLE COUPLER MUST HAVE A RATED TOWING CAPACITY EQUAL TO OR GREATER THAN THE TRAILER **Gross Vehicle Weight Rating (GVWR)**.

IT IS ESSENTIAL THAT THE PINTLE HITCH BE OF THE SAME SIZE AS THE PINTLE COUPLER.

The coupler size and load rating (capacity) are marked on the coupler. Hitch capacity is marked on the hitch.

⚠ WARNING

Coupler-to-hitch mismatch can result in uncoupling, leading to death or serious injury.

Be sure the **LOAD RATING** of the pintle hitch hook is equal or greater than the load rating of the pintle eye coupler.

Be sure the **SIZE** of the pintle hitch hook matches the size of the pintle eye coupler.

⚠ WARNING

A worn, cracked or corroded pintle hitch hook can fail while towing, and may result in death or serious injury.

Before coupling trailer, inspect the pintle hitch hook for wear, corrosion and cracks.

Replace worn or damaged pintle hitch hook.

- Rock the pintle eye coupler to make sure it is secured tightly to the hitch.
- Wipe the inside and outside of the pintle coupler. Clean and inspect it visually for cracks and deformations. Feel the inside of the coupler for worn spots and pits.
- Be sure the coupler is secured tightly to the tongue of the trailer. All coupler fasteners must be visibly solid against the trailer frame.
- Raise the bottom surface of the coupler to be above the top of the pintle hitch hook. Use the tongue jackstand to support the trailer tongue. Wood or concrete blocks may also be used.

⚠ WARNING

A defective pintle hitch not properly fastened can result in uncoupling, leading to death or serious injury.

Be sure the pintle hook is securely tightened to the tow vehicle before coupling the trailer.

Coupling Trailer to Tow Vehicle (Pintle Coupler)

- Slowly back up the tow vehicle so that the pintle hitch hook is near or aligned under the pintle eye ring coupler.
- Using the jackstand at the front of trailer (tongue), turn the jackstand crank handle to raise the trailer. If the pintle eye coupler does not line up with the pintle hitch hook, adjust the position of the tow vehicle.
- **OPEN** the pintle hook locking mechanism (Figure H). Place the hook inside the eye coupler. **CLOSE** the pintle hook mechanism.

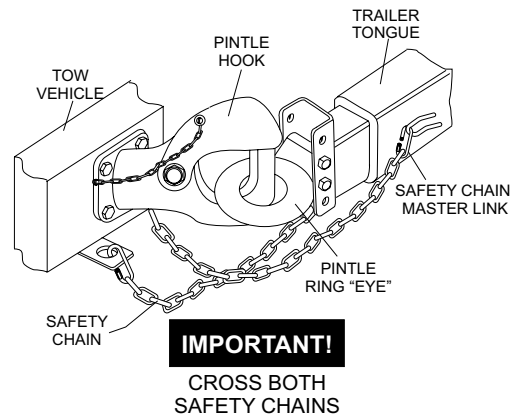


Figure H. Attaching Safety Chain (Pintle Hitch)

- Insert a pin or lock through the hole in the locking mechanism.
- Be sure the pintle hook is inserted completely through the eye ring and the locking mechanism is engaged. A properly engaged locking mechanism will allow the coupler to raise the rear of the tow vehicle. Using the trailer jack, test to see that you can raise the rear of the tow vehicle by 1-inch after the coupler is locked to the hitch.
- Lower the trailer so that its entire tongue weight is held by the hitch.
- Raise the jackstand to a height where it will not interfere with the road.

SAFETY GUIDELINES — TRAILERS

TIRE SAFETY

Unsafe Tires, Lug Nuts or Wheels

Trailer tires and wheels are more likely to fail than car tires and wheels because they carry a heavier load. Therefore, it is essential to inspect the trailer tires before each tow.

If a tire has a bald spot, bulge, cuts, is showing any cords, or is cracked, replace the tire before towing. If a tire has uneven tread wear, take the trailer to a dealer service center for diagnosis.

Uneven tread wear can be caused by tire imbalance, axle misalignment or incorrect inflation.

Tires with too little tread will not provide adequate tracking on wet roadways and can result in loss of control, leading to death or serious injury.

Improper tire pressure causes an unstable trailer and can result in a tire blowout and loss of control. Therefore, before each tow you must also check the tire pressure. Tire pressure must be checked when tires are cold.

Allow 3 hours cool-down after driving as much as 1 mile at 40 mph before checking tire pressure. Trailer tires will be inflated to higher pressures than passenger vehicle tires.

Since trailer wheels and lug nuts (or bolts) are subjected to greater side loads than automobile wheels, they are more prone to loosen. Before each tow, check to make sure they are tight.

The proper tightness (torque) for lug nuts is listed in the lug nut tightening section of this manual. Use a torque wrench to tighten the lug nuts. If you do not have a torque wrench, use a lug wrench (from your tow vehicle) and tighten the nuts as much as you can. Then have a service garage or trailer dealer tighten the lug nuts to the proper torque.

WARNING

Metal creep between the wheel rim and lug nuts will cause rim to loosen and could result in a wheel coming off, leading to death or serious injury.

Tighten lug nuts before each tow.

Lug nuts are also prone to loosen after first being assembled. When driving a new trailer (or after wheels have been remounted), check to make sure they are tight after the first 10, 25 and 50 miles of driving and before each tow thereafter.

Failure to perform this check can result in a wheel parting from the trailer and a crash, leading to death or serious injury.

WARNING

Lug nuts are prone to loosen after initial installation, which can lead to death or serious injury.

Check lug nuts for tightness on a new trailer or when wheel(s) have been remounted after the first 10, 25 and 50 miles of driving.

WARNING

Improper lug nut torque can cause a wheel parting from the trailer, leading to death or serious injury.

Be sure lug nuts are tight before each tow.

WARNING

Improper tire pressure can result in a blowout and loss of control, which can lead to death or serious injury.

Be sure tires are inflated to pressure indicated on side wall before towing trailer.

Determining Load Limit of Trailer

Determining the load limits of a trailer includes more than understanding the load limits of the tires alone. On all trailers there is a Federal certification/VIN label that is located on the forward half of the left (road) side of the unit. This certification/VIN label will indicate the trailer's Gross Vehicle Weight Rating (GVWR). This is the most weight the fully loaded trailer can weigh. It will also provide the Gross Axle Weight Rating (GAWR). This is the most a the axle can weigh.

SAFETY GUIDELINES — TRAILERS

There is a vehicle placard (Figure I) located in the same location as the certification label described above. This placard provides tire and loading information. In addition, this placard will show a statement regarding maximum cargo capacity.

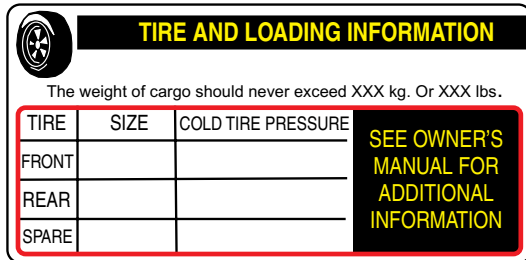


Figure I. Trailer Tire Placard

If additional work items (hoses, tools, clamps etc.) are going to be added to the trailer, be sure they are distributed evenly to prevent overloading front to back and side to side. Heavy items should be placed low and as close to the axle positions as reasonable. Too many items on one side may overload a tire.

Excessive loads and/or underinflation cause tire overloading and, as a result, abnormal tire flexing occurs. This situation can generate an excessive amount of heat within the tire. Excessive heat may lead to tire failure. It is the air pressure that enables a tire to support the load, so proper inflation is critical. The proper air pressure may be found on the certification/VIN label and/or on the Tire and Loading Information placard. This value should never exceed the maximum cold inflation pressure stamped on the tire.

Perform the following steps to determine the load limit of your trailer.

Step 1.

Locate the statement, “The weight of cargo should never exceed XXX kg or XXX lbs.,” on your vehicle’s Tire and Loading Information placard (Figure I). This value equals the available amount of equipment load capacity.

Step 2.

Determine the weight of the equipment being loaded on the tow vehicle. That weight may not safely exceed the available equipment load capacity. The trailer’s Tire Information Placard is attached adjacent to or near the trailer’s VIN (Certification) label at the left front of the trailer (See Figure I).

Determining Load Limit of Tow Vehicle

Step 1.

Locate the statement, “The combined weight of occupants and cargo should never exceed XXX lbs.,” on your vehicle’s placard.

Step 2.

Determine the combined weight of the driver and passengers who will be riding in your vehicle.

Step 3.

Subtract the combined weight of the driver and passengers from XXX kilograms or XXX pounds.

Step 4.

The resulting figure equals the available amount of cargo and luggage capacity. For example, if the “XXX” amount equals 1400 lbs. and there will be five 150 lb. passengers in your vehicle, the amount of available cargo and luggage capacity is 650 lbs. (1400-750 (5 x 150) = 650 lbs.).

Step 5.

Determine the combined weight of luggage and cargo being loaded on the vehicle. That weight may not safely exceed the available cargo and luggage capacity calculated in Step 4.

If your vehicle will be towing a trailer, load from your trailer will be transferred to your vehicle. Consult the tow vehicle’s manual to determine how this weight transfer reduces the available cargo and luggage capacity of your vehicle.

Studies of tire safety show that maintaining proper tire pressure, observing tire and vehicle load limits (not carrying more weight in your vehicle than your tires or vehicle can safely handle), avoiding road hazards and inspecting tires for cuts, slashes and other irregularities are the most important things you can do to avoid tire failure, such as tread separation or blowout and flat tires. These actions, along with other care and maintenance activities, can also:

- Improve vehicle handling.
- Help protect you and others from avoidable breakdowns and accidents.
- Improve fuel economy.
- Increase the tire life.

SAFETY GUIDELINES — TRAILERS

Use the information contained in this section to make tire safety a regular part of your vehicle maintenance routine. Recognize that the time you spend is minimal compared with the inconvenience and safety consequences of a flat tire or other tire failure.

TIRE FUNDAMENTALS

Federal law requires tire manufacturers to place standardized information on the sidewall of all tires (Figure J). This information identifies and describes the fundamental characteristics of the tire and also provides a tire identification number for safety standard certification and in case of a recall.

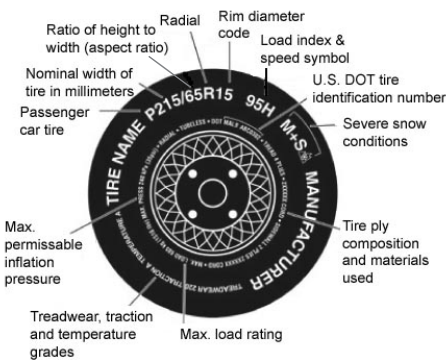


Figure J. Standard Tire Sidewall Information

P: The “P” indicates the tire is for passenger vehicles.

Next number: This three-digit number gives the width in millimeters of the tire from sidewall edge to sidewall edge. In general, the larger the number, the wider the tire.

Next number: This two-digit number, known as the aspect ratio, gives the tire’s ratio of height to width. Numbers of 70 or lower indicate a short sidewall for improved steering response and better overall handling on dry pavement.

P: The “R” stands for radial. Radial ply construction of tires has been the industry standard for the past 20 years.

Next number: This two-digit number is the wheel or rim diameter in inches. If you change your wheel size, you will have to purchase new tires to match the new wheel diameter.

Next number: This two- or three-digit number is the tire’s load index. It is a measurement of how much weight each tire can support. You may find this information in your owner’s manual. If not, contact a local tire dealer. *Note:* You may not find this information on all tires because it is not required by law.

M+S: The “M+S” or “M/S” indicates that the tire has some mud and snow capability. Most radial tires have these markings; hence, they have some mud and snow capability.

Speed Rating: The speed rating denotes the speed at which a tire is designed to be driven for extended periods of time. The ratings range from 99 miles per hour (mph) to 186 mph. These ratings are listed in Table A. *Note:* You may not find this information on all tires because it is not required by law.

Letter Rating	Speed Rating
Q	99 mph
R	106 mph
S	112 mph
T	118 mph
U	124 mph
H	130 mph
V	149 mph
W	168* mph
Y	186* mph

U.S. DOT Tire Identification Number: This begins with the letters “DOT” and indicates that the tire meets all federal standards. The next two numbers or letters are the plant code where it was manufactured, and the last four numbers represent the week and year the tire was built. For example, the numbers 3197 means the 31st week of 1997. The other numbers are marketing codes used at the manufacturer’s discretion. This information is used to contact consumers if a tire defect requires a recall.

Tire Ply Composition and Materials Used: The number of plies indicates the number of layers of rubber-coated fabric in the tire. In general, the greater the number of plies, the more weight a tire can support. Tire manufacturers also must indicate the materials in the tire, which include steel, nylon, polyester, and others.

Maximum Load Rating: This number indicates the maximum load in kilograms and pounds that can be carried by the tire.

Maximum Permissible Inflation Pressure: This number is the greatest amount of air pressure that should ever be put in the tire under normal driving conditions.

SAFETY GUIDELINES — TRAILERS

Uniform Tire Quality Grading Standards (UTQGS)

Treadwear Number: This number indicates the tire's wear rate. The higher the treadwear number is, the longer it should take for the tread to wear down. For example, a tire graded 400 should last twice as long as a tire graded 200.

Traction Letter: This letter indicates a tire's ability to stop on wet pavement. A higher graded tire should allow you to stop your car on wet roads in a shorter distance than a tire with a lower grade. Traction is graded from highest to lowest as "AA", "A", "B", and "C".

Temperature Letter: This letter indicates a tire's resistance to heat. The temperature grade is for a tire that is inflated properly and not overloaded. Excessive speed, underinflation or excessive loading, either separately or in combination, can cause heat build-up and possible tire failure. From highest to lowest, a tire's resistance to heat is graded as "A", "B", or "C".

Refer to Figure K for additional tire information for light trucks.

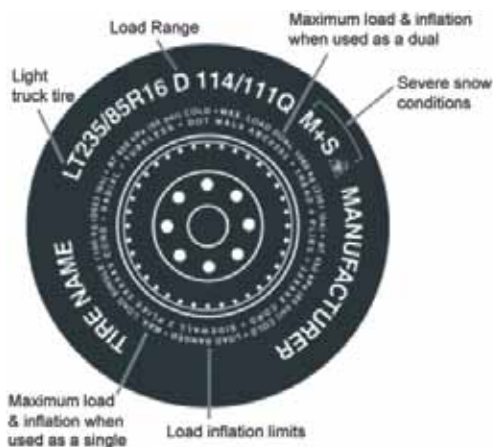


Figure K. UTQGS Tire Information

Tires for light trucks have other markings besides those found on the sidewalls of passenger tires.

LT: The "LT" indicates the tire is for light trucks or trailers.

ST: An "ST" is an indication the tire is for trailer use only.

Max. Load Dual kg (lbs) at kPa (psi) Cold: This information indicates the maximum load and tire pressure when the tire is used as a dual, that is, when four tires are put on each rear axle (a total of six or more tires on the vehicle).

Max. Load Single kg (lbs) at kPa (psi) Cold: This information indicates the maximum load and tire pressure when the tire is used as a single.

Load Range: This information identifies the tire's load-carrying capabilities and its inflation limits.

Tire Safety Tips

- Slow down if you have to go over a pothole or other object in the road.
- **DO NOT** run over curbs or other foreign objects in the roadway, and try not to strike the curb when parking.
- Check tire inflation pressure weekly during use to insure the maximum tire life and tread wear.
- **DO NOT** bleed air from tires when they are hot.
- Inspect tires for uneven wear patterns on the tread, cracks, foreign objects, or other signs of wear or trauma.
- Remove bits of glass and foreign objects wedged in the tread.
- Make sure your tire valves have valve caps.
- **ALWAYS** check tire pressure on tow vehicle and trailer before towing. Check tire pressure at least once a month.
- **DO NOT** overload tow vehicle. Check the tire information and loading placard for safe allowable tire loading conditions.

Tire Repair







The proper repair of a punctured tire requires a plug for the hole and a patch for the area inside the tire that surrounds the puncture hole. Punctures through the tread can be repaired if they are not too large, but punctures to the sidewall should not be repaired. Tires must be removed from the rim to be properly inspected before being plugged and patched.

Replacing Worn or Damaged Tires


Replace the tire before towing the trailer if the tire treads have less than 1/16 inch depth or the telltale bands are visible. Check inflation pressure weekly during use to insure the maximum tire life and tread wear. A bubble, cut or bulge in a side wall can result in a tire blowout. Inspect both side walls of each tire for any bubble, cut or bulge; and replace a damaged tire before towing the trailer.

SAFETY GUIDELINES — TRAILERS

Table B below will help pinpoint the causes and solutions of tire wear problems.

Table B. Tire Wear Troubleshooting			
Wear Pattern		Cause	Solution
	Center Wear	Over inflation.	Adjust pressure to particular load per tire manufacturer.
	Edge Wear	Under inflation.	Adjust pressure to particular load per tire manufacturer.
	Side Wear	Loss of camber or overloading.	Make sure load does not exceed axle rating. Align wheels.
	Toe Wear	Incorrect toe-in.	Align wheels.
	Cupping	Out-of-balance.	Check bearing adjustment and balance tires.
	Flat Spots	Wheel lockup and tire skidding.	Avoid sudden stops when possible and adjust brakes.

WARNING



ALWAYS wear safety glasses when removing or installing force fitted parts. **DO NOT** attempt to repair or modify a wheel. **DO NOT** install an inner-tube to correct a leak through through the rim. If the rim is cracked, the air pressure in the inner tube may cause pieces of the rim to explode (break off) with great force and cause serious eye or bodily injury.

Wheel Rims

If the trailer has been struck, or impacted, on or near the wheels, or if the trailer has struck a curb, inspect the rims for damage (i.e. being out of round); and replace any damaged wheel. Inspect the wheels for damage every year, even if no obvious impact has occurred.

Wheels, Bearings and Lug Nuts

A loose, worn or damaged wheel bearing is the most common cause of brakes that grab.

To check wheel bearings, jack trailer and check wheels for side-to-side looseness. If the wheels are loose, or spin with a wobble, the bearings must be serviced or replaced. Check inflation pressure weekly during use to insure the maximum tire life and tread wear. Most trailer axles are built with sealed bearings that are not serviceable. Sealed bearings must be replaced as complete units.

NOTICE

NEVER use an pneumatic air gun to tighten wheel lug nuts.

Over-tightening lug nuts will result in breaking the studs or permanently deforming the mounting stud holes in the wheels.

WARNING

Lug nuts are prone to loosen after initial installation, which can lead to death or serious injury. Check all wheel lug nuts periodically.

Lug Nut Torque Requirements

It is extremely important to apply and maintain proper wheel mounting torque on the trailer. Be sure to use only the fasteners matched to the cone angle of the wheel. Proper procedure for attachment of the wheels is as follows:

1. Start all wheel lug nuts by hand.
2. Torque all lug nuts in sequence. See Figure L. **DO NOT** torque the wheel lug nuts all the way down. Tighten each lug nut in 3 separate passes as defined by Table C.
3. Check to see if the lug nuts are tight after the first 10, 25 and 50 miles of driving and before each tow thereafter

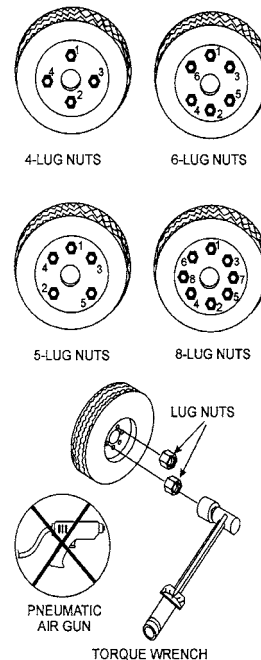


Figure L. Wheel Lug Nuts Tightening Sequence

SAFETY GUIDELINES — TRAILERS

Table C. Tire Torque Requirements

Wheel Size	First Pass FT-LBS	Second Pass FT-LBS	Third Pass FT-LBS
12"	20-25	35-40	50-65
13"	20-25	35-40	50-65
14"	20-25	50-60	90-120
15"	20-25	50-60	90-120
16"	20-25	50-60	90-120

Replace any broken or burned-out lamps as necessary. Check the wire harness for cuts, fraying or other damage. If it needs replacing, contact your dealer.

⚠ WARNING

Improper operating taillights, stoplights and turn signals can cause collisions.

Check all lights before each tow.

Lights and Signals

Before each tow, check the trailer taillights, stoplights, turn signals and any clearance lights for proper operation.

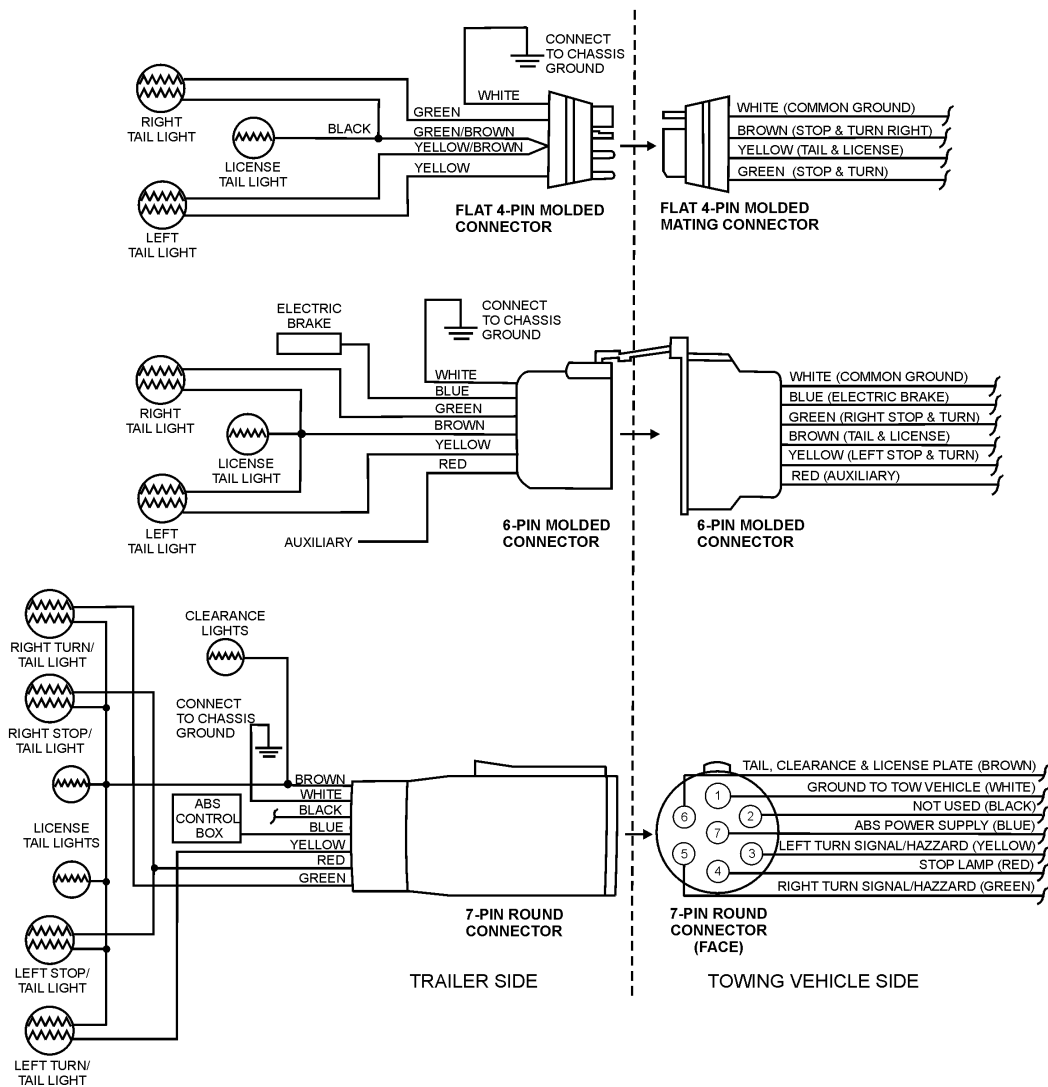


Figure M. Trailer to Tow Vehicle Wiring Diagram

TROUBLESHOOTING

Table 5. Lamp Troubleshooting

Symptom	Possible Cause	Solution
Lamp will not start.	Lamp Burned Out?	Test the lamp in a fixture which is operating properly. Replace if necessary.
	Lamp Loose in Socket?	Inspect lamp base to see if there is arcing at center contact button. Tighten lamp snugly. Check socket for damage. Replace if defective.
	Lamp Plugs Not Tight?	Check plug and receptacle. Tighten if loose.
	Defective Ballast?	Interchange ballast plugs in generator enclosure. If lamp starts, replace ballast. Check ballast wiring against diagram. Check for swollen capacitor, charred wiring, core and coil or other signs of excessive heat.
	Low Voltage?	Check line voltage at ballast input. Voltage should be within 10% of nameplate rating when operating at normal load. Increase supply voltage or remove external load.
	Improper Ballast?	Proper HID lamps will perform erratically or fail to start on an improper ballast. The ballast nameplate data must agree with the line voltage and lamp used. Improper ballast causes lamp failure. Note: Mercury lamps of the same wattage will operate properly on Metal Halide ballasts.
	Improper Lamp Operating Position (Metal Halide only)?	Operating position should agree with the lamp tech. A BU-HOR lamp can be operated base up vertical to and including the horizontal and a BD can be operated base down vertical to, approaching, but not including the horizontal. A lamp operated beyond the specified position may not start.
Lamp has been Operating: Cool Down Time Insufficient?	HID lamps (High Pressure Sodium, Metal Halide, Mercury Vapor) require from 4 to 8 minutes cool-down time before restarting. Switch off breaker and allow lamp to cool.	
Lamp flickers and goes out intermittent or cycling.	Improper Ballast?	Improper ballasting can cause flickering or erratic operation. In the start-up period the lamp may ignite, start to warm up and then extinguish (cycle).
	New Lamp?	Under certain conditions new lamps may "cycle". Usually after 3 tries to start at 30 to 60 second intervals, lamps will stabilize and operate satisfactorily.
	Defective Lamp?	Replace lamp.

TROUBLESHOOTING

Table 5. Lamp Troubleshooting (continued)

Symptom	Possible Cause	Solution
Lamp starts slowly (ARC does not strike when switch is first turned on)	Defective Lamp?	Lamp may glow for extended period of time. Replace after checking voltage and ballast.
Circuit breaker trips on lamp start-up	Short Circuit or Ground?	Check wiring against diagram. Check for shorts or ground.
Lamp light output low	Normal Lamp Depreciation?	Replace Lamp.
	Dirty Lamp or Fixture?	Clean lamp and fixture.
	Defective Ballast?	Interchange ballast plugs in generator enclosure. If lamp returns to normal light output, replace ballast. Check for swollen capacitor, charred wiring, core and coil, or other signs of excessive heat.
	Wrong Voltage?	Check voltage at ballast input. Voltage should be within 10% of nameplate rating. Check wiring connections for voltage loss. Check socket contact point.
	Improper Ballast?	Check ballast nameplate against lamp data.
Lamp colors different.	Normal Lamp Depreciation?	Lamp output and brightness decreases and color changes slightly as lamps age. Spot replacement with new lamps may cause noticeable differences in lamp colors. Group replacement minimizes color differences.
	Dirty Fixture?	Dirty fixtures will cause lamps to appear different in color. Clean fixture.
	Wrong Lamp?	Check data on lamps which appear different in color. Replace with correct color lamp.
ARC tube discolored or swollen.	Over Voltage from Power Supply?	Check voltage at ballast. Check for current or voltage surges. Check for shorted capacitors and replace if defective.
	Improper Ballast?	Lamp operated on ballast designed for higher wattage lamp. Check ballast nameplate against lamp data.
Short lamp life.	Lamp Damaged?	Check for outer bulb cracks. If air enters outer bulb, arc tube may continue to burn for 100 hours before failure. Check for bulb cracks where glass meets the base due to tightening Lamp too firmly in socket or scoring of glass where socket inadvertently touches the lamp bulb. Look for broken arc tube or loose metal parts. Replace lamp. (Bulb leads will cause oxidation of metal parts.)
	Improper Ballast?	Ballast nameplate data should agree with lamp line voltage and lamp use. If improper ballast is used, the lamp life will be shortened. A mismatch may also cause the ballast to fail.

LAMP TROUBLESHOOTING GUIDE

Use the following procedure and wiring diagrams on the next pages to determine which of the four lamps is not functioning:

Connections

1. Make sure that lamp #1 power cable is plugged into the J1 connector on the T-Bar assembly.
2. Make sure that lamp #2 power cable is plugged into the J2 connector on the T-Bar assembly.
3. Make sure that lamp #3 power cable is plugged into the J3 connector on the T-Bar assembly.
4. Make sure that lamp #4 power cable is plugged into the J4 connector on the T-Bar assembly.
5. Make sure that lamp #5 power cable is plugged into the J5 connector on the T-Bar assembly.
6. Make sure that lamp #6 power cable is plugged into the J6 connector on the T-Bar assembly.

NOTICE

MLT20DCA (4-lamp) only uses receptacles J1 through J4.

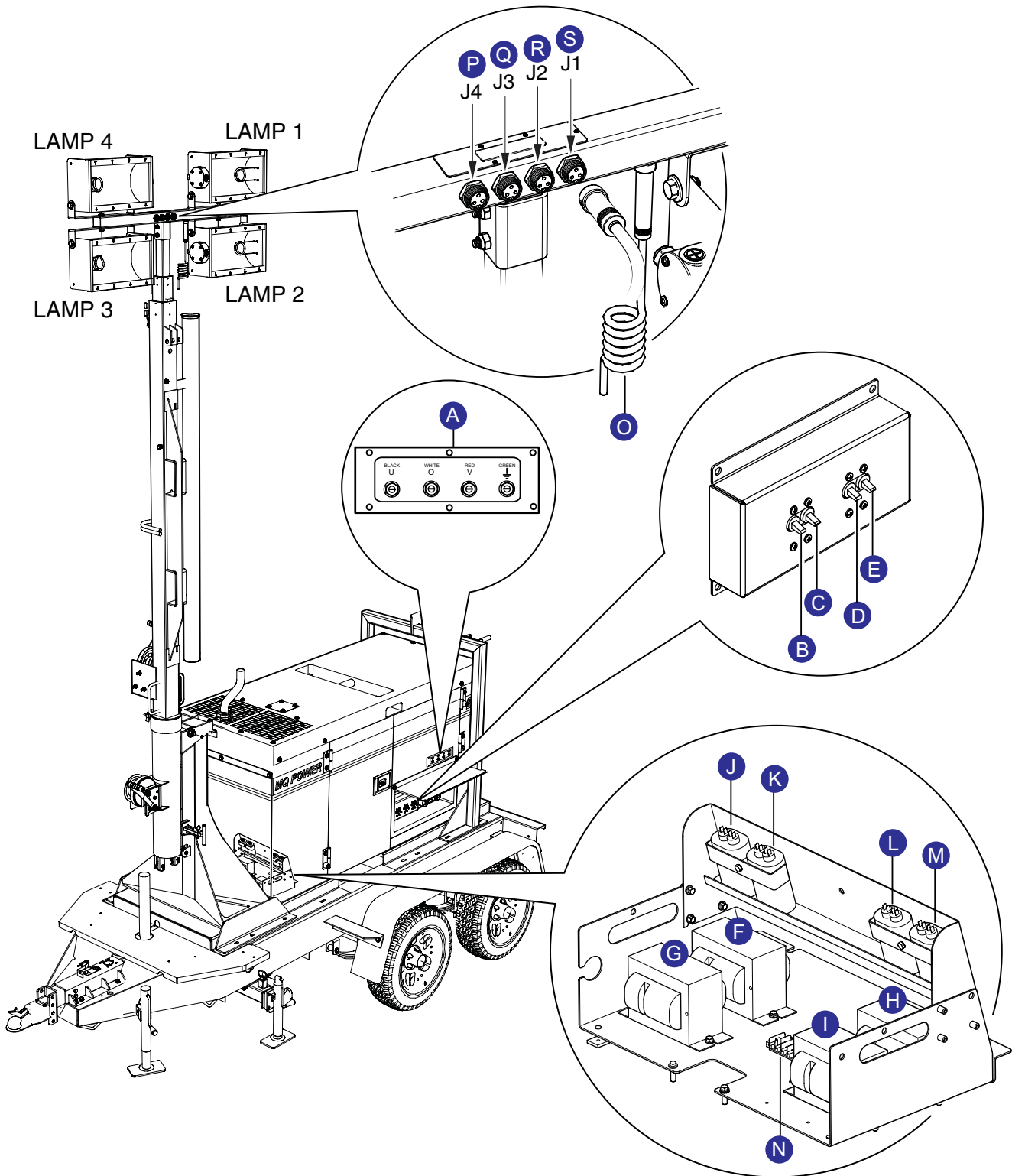
Starting

1. Start the generator and verify that there are no abnormal sounds.
 2. Turn CB1 thru CB6 circuit breakers to the ON position.
 3. Wait a few minutes and determine which lamp is not igniting.
 4. If one of the lamps is OFF, disconnect its power cable and plug it into a receptacle that is known to be working. DO NOT unplug a power cable from the T-Bar while power is being supplied by the generator. Always turn the circuit breaker OFF before unplugging a power cable.
 5. If the lamp still does not ignite after plugging it into a working receptacle (120 VAC present), then the lamp is defective and has to be replaced.
6. If the lamp ignites after plugging it into a working receptacle, continue with step 7.
 7. With the voltmeter set to the AC position, connect the negative lead of the AC voltmeter to any (neutral) white wire on the junction terminal block. This block connects all the neutral wires (white) in the system.
 8. Connect the positive lead of the voltmeter to the output side of the circuit breaker where the lamp was originally OFF and observe that 120 VAC is present. Make sure circuit breaker is ON.
 9. If no output voltage is present, the circuit breaker is defective and needs to be replaced.
 10. If the correct output voltage is present then it can be assumed that the generator is working correctly and the correct voltage (120 VAC) is being supplied to the ballast. Then it can be assumed that the ballast for that lamp is defective. Replace ballast.

Ballast Removal

1. Remove the power cable from the generator, and make sure that no voltage is being supplied to the ballast compartment.
2. Remove the four screws securing the ballast cover, and remove cover.
3. Make sure to discharge the ballast capacitor.
4. Remove the defective ballast, taking care to guard against electrical shock when coming in contact with the ballast and capacitor. The capacitor is known to store an electrical charge, that when discharged could result in a harmful shock. Make sure to discharge capacitor.

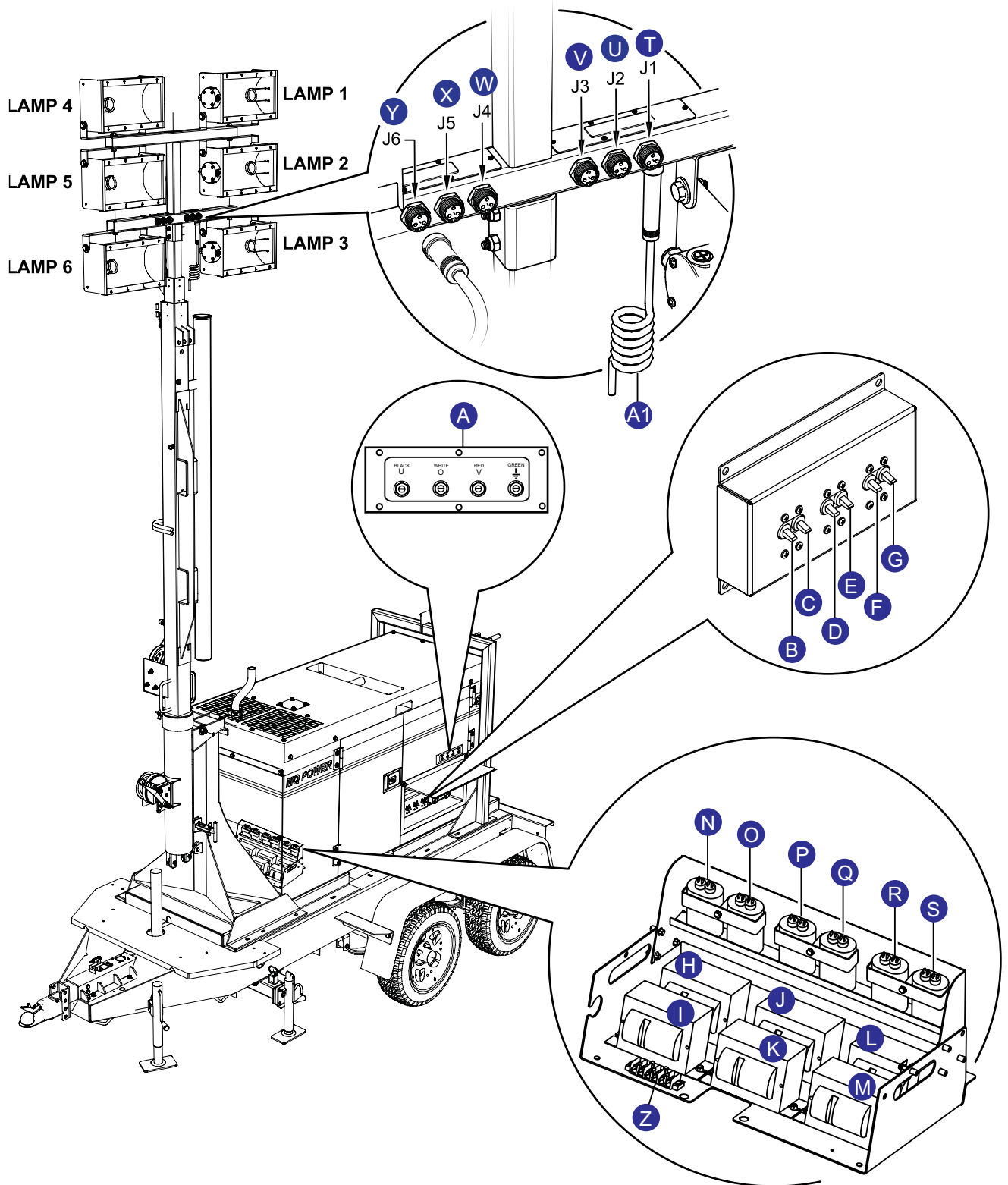
ELECTRONIC COMPONENT LOCATOR (MLT20DCA)



NOTICE

Reference MLT20DCA (4-lamp) wiring diagram on succeeding pages.

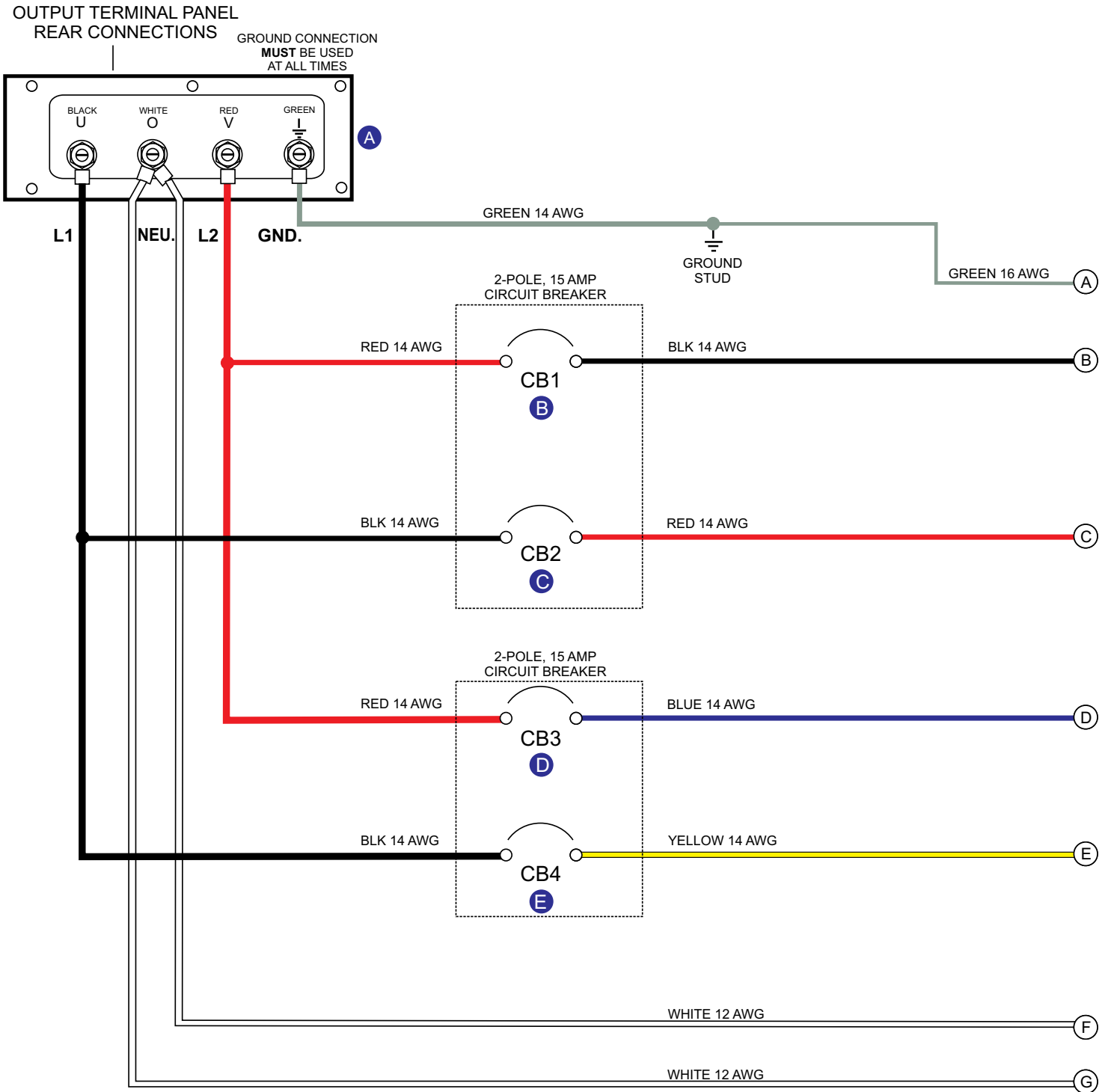
ELECTRONIC COMPONENT LOCATOR (MLT20DCA6)



NOTICE

Reference MLT20DCA6 (6-lamp) wiring diagram on succeeding pages.

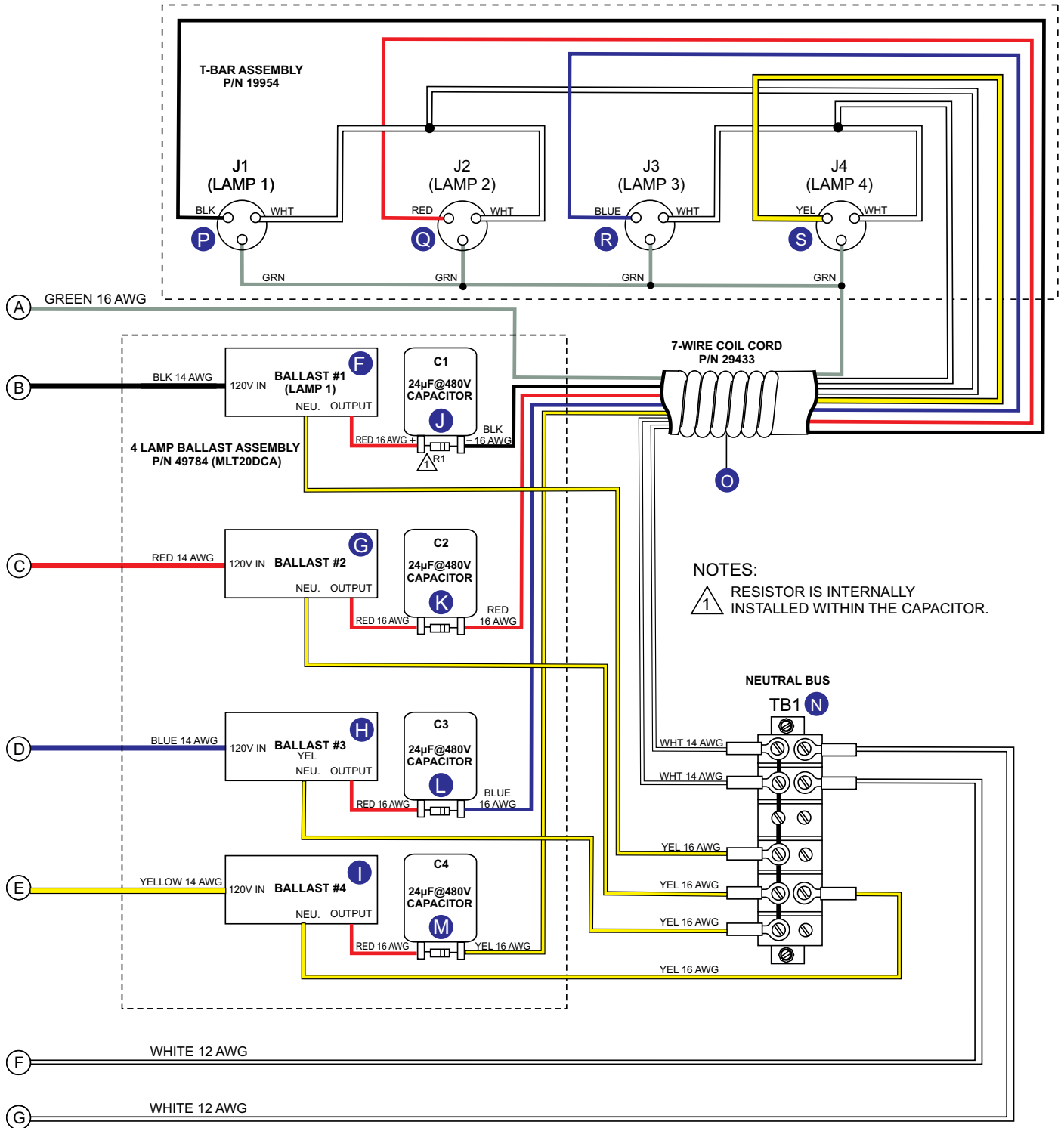
WIRING DIAGRAM (MLT20DCA)



NOTICE

Reference MLT20DCA (4-lamp) locator diagram on preceding pages.

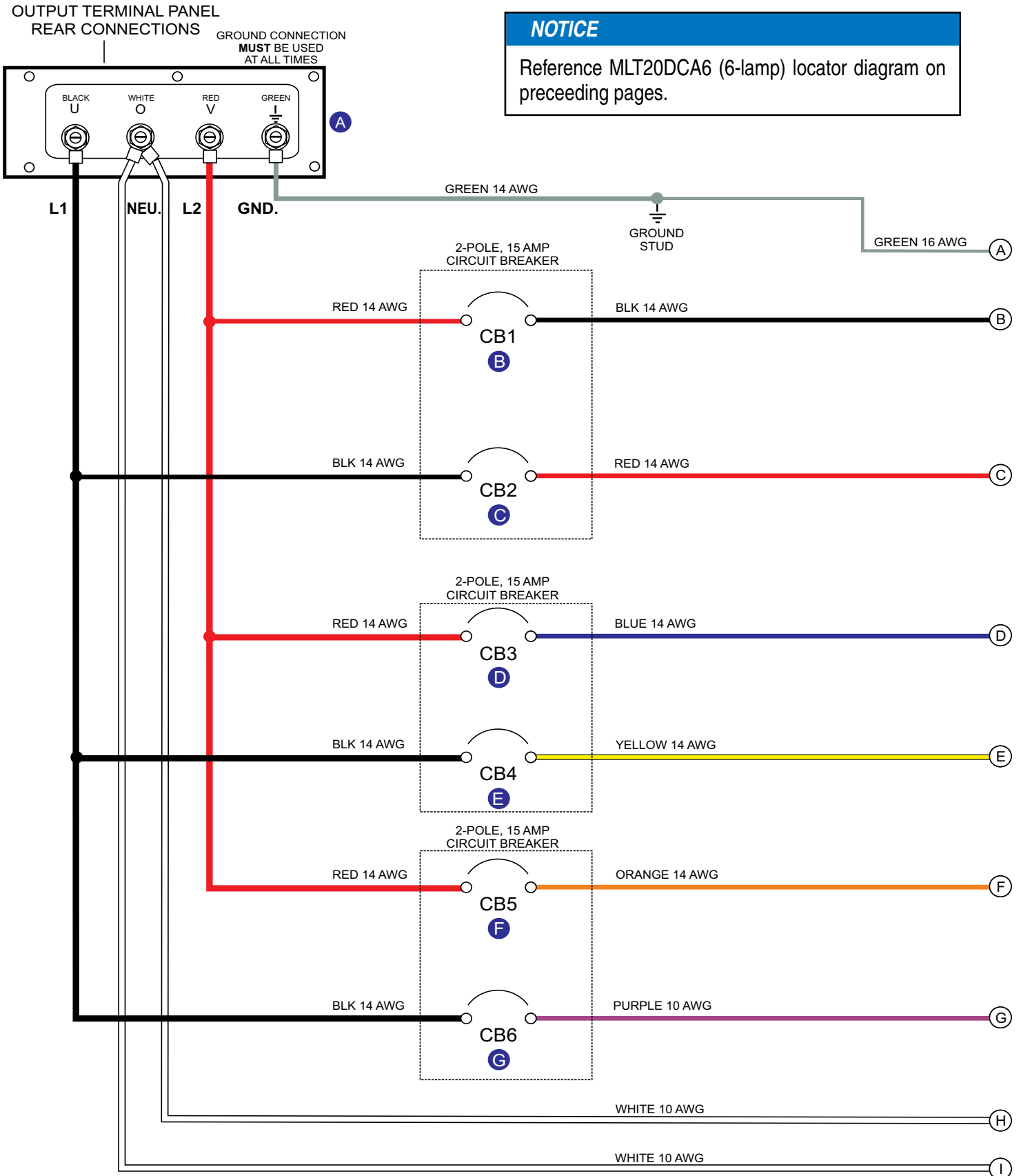
WIRING DIAGRAM (MLT20DCA)



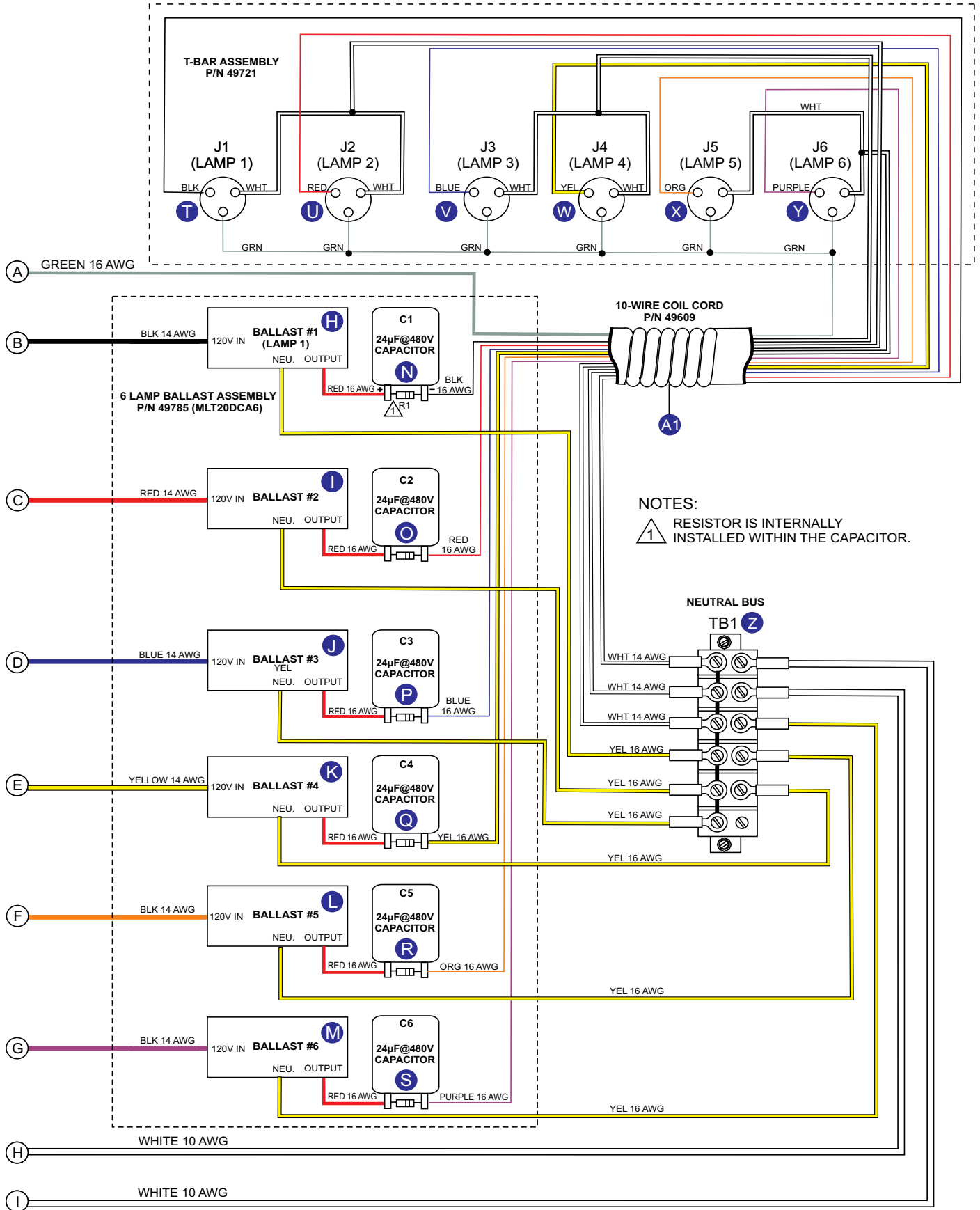
WIRING DIAGRAM (MLT20DCA6)

NOTICE

Reference MLT20DCA6 (6-lamp) locator diagram on preceding pages.



WIRING DIAGRAM (MLT20DCA6)



OPERATION MANUAL

HERE'S HOW TO GET HELP

PLEASE HAVE THE MODEL AND SERIAL
NUMBER ON-HAND WHEN CALLING

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Fax (310) 537-3927

Service Department

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310-537-3700

Fax: 310-537-4259

Technical Assistance

800-478-1244

Fax: 310-943-2238

MQ Parts Department

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310-537-3700

Fax: 800-672-7877
Fax: 310-637-3284

Warranty Department

800-421-1244
310-537-3700

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